

Figure 1

Publication	PECVD Reaction	Doping Control Method	Post-doping Thermal Treatment T ₂ (°C)
Valette S., 1987	Unknown	P doping	Not specified
Valette S., 1988	Unknown	P doping	400°C
Grand G., 1990	Unknown	P doping	1000°C
Liu K., 1995	Unknown	Content in Si, P	Not specified
Ojha S., 1998	Unknown	Ge, B, or P doping	Not specified
Canning J., 1998	Unknown	Ge doping	Not specified
Bulla D., 1998	TEOS	TEOS	Not specified
Johnson C., 1998	SiH ₄ + O ₂	Si ion Implantation	400°C
Boswell R. W., 1997	SiH ₄ + O ₂	SiH ₄ /O ₂ flow ratio	1000°C
Bazylenko M. V., 1995	SiH ₄ + O ₂ + CF ₄	(SiH ₄ +O ₂)/CF ₄ flow ratio	Not specified
Bazylenko M. V., 1996	SiH ₄ + O ₂ + CF ₄	(SiH ₄ +O ₂)/CF ₄ flow ratio	1000°C
Durandet A., 1996	SiH ₄ + O ₂ + CF ₄	SiH ₄ /O ₂ /CF ₄ flow ratio	100°C
Kapser K., 1991	SiH ₄ + N ₂ O	SiH ₄ /N ₂ O flow ratio	1060°C
Lai Q., 1992	SiH ₄ + N ₂ O	SiH ₄ /N ₂ O flow ratio	1100°C
Lai Q., 1993	SiH ₄ + N ₂ O	SiH ₄ /N ₂ O flow ratio	1100°C
Pereyra I., 1997	SiH ₄ + N ₂ O	SiH ₄ /N ₂ O flow ratio	400°C
Alayo M., 1998	SiH ₄ + N ₂ O	SiH ₄ /N ₂ O flow ratio	1000°C
Kenyon T., 1997	SiH ₄ + N ₂ O + Ar	SiH ₄ /N ₂ O/Ar flow ratio	1000°C
Lam D. K. W., 1984	SiH ₄ + N ₂ O + NH ₃	SiH ₄ /N ₂ O/NH ₃ flow ratio	Not specified
Bruno F., 1991	SiH ₄ + N ₂ O + NH ₃	SiH ₄ /N ₂ O/NH ₃ flow ratio	1100°C
Yokohama S., 1995	SiH ₄ + N ₂ O + NH ₃	SiH ₄ /N ₂ O/NH ₃ flow ratio	Not specified
Agnihotri O. P., 1997	SiH ₄ + N ₂ O + NH ₃	SiH ₄ /N ₂ O/NH ₃ flow ratio	700-900°C
Germann R., 1999	SiH ₄ + N ₂ O + NH ₃	Unknown	1100°C
Offrein B., 1999	SiH ₄ + N ₂ O + NH ₃	Unknown	1150°C
Hoffmann M., 1995	SiH ₄ + N ₂ O + NH ₃ + Ar	SiH ₄ /N ₂ O/NH ₃ /Ar flow ratio	Not specified
Hoffmann M., 1997	SiH ₄ + N ₂ O + NH ₃ + Ar	SiH ₄ /N ₂ O/NH ₃ /Ar flow ratio	Not specified
Tu Y., 1995	SiH ₄ + N ₂ O + NH ₃ + N ₂	N ₂ O/(N ₂ O + NH ₃) flow ratio	1050°C
Poenar D., 1997	SiH ₄ + N ₂ O + NH ₃ + N ₂	SiH ₄ /N ₂ O/NH ₃ /N ₂ flow ratio	850°C
Ridder R., 1998	SiH ₄ + N ₂ O + NH ₃ + N ₂	SiH ₄ /N ₂ O/NH ₃ /Ar flow ratio	1100°C
Worhoff K., 1999	SiH ₄ + N ₂ O + NH ₃ + N ₂	SiH ₄ /N ₂ O/NH ₃ /N ₂ flow ratio	1150°C
Bulat E.S., 1993	SiH ₄ + N ₂ O + N ₂ + O ₂ + He + CF ₄	SiH ₄ /(N ₂ O/N ₂)/O ₂ /CF ₄ flow ratio	425°C
This Patent Application	SiH ₄ + N ₂ O + PH ₃ + N ₂	Patented Pending Method	650°C

Figure 2

	H-O-H	S-O-H	S-N-H	S-N-H	S-H	S=O	N=N	S-O-S	S-O-S	S-O-N	S-O-H	S-O-S	S-O-S
Min	3550	3470	3380	3300	2210	1800	1530	1080	1000	910	860	740	410
Ave	3650	3510	3420	3380	2260	1875	1555	1180	1080	950	885	810	460
Max	3750	3550	3460	3460	2310	1950	1580	1280	1160	990	910	880	510
Min	2.817	2.882	2.959	3.030	4.525	5.556	6.536	9.259	10.000	10.989	11.628	13.514	24.390
Ave	2.740	2.849	2.924	2.959	4.425	5.333	6.431	8.475	9.259	10.526	11.299	12.346	21.739
Max	2.667	2.817	2.890	2.890	4.329	5.128	6.329	7.813	8.621	10.101	10.989	11.364	19.608
Min	1.408	1.441	1.479	1.515	2.262	2.778	3.268	4.630	5.000	5.495	5.814	6.757	12.195
Ave	1.370	1.425	1.462	1.479	2.212	2.667	3.215	4.237	4.630	5.263	5.650	6.173	10.870
Max	1.333	1.408	1.445	1.445	2.165	2.564	3.165	3.906	4.310	5.051	5.495	5.682	9.804
Min	0.939	0.961	0.986	1.010	1.508	1.852	2.179	3.086	3.333	3.663	3.876	4.505	8.130
Ave	0.913	0.950	0.975	0.986	1.475	1.778	2.144	2.825	3.086	3.509	3.766	4.115	7.246
Max	0.889	0.939	0.963	0.963	1.443	1.709	2.110	2.604	2.874	3.367	3.663	3.788	6.536
Min	0.704	0.720	0.740	0.758	1.131	1.389	1.634	2.315	2.500	2.747	2.907	3.378	6.098
Ave	0.685	0.712	0.731	0.740	1.106	1.333	1.608	2.119	2.315	2.632	2.825	3.086	5.435
Max	0.667	0.704	0.723	0.723	1.082	1.282	1.582	1.953	2.155	2.525	2.747	2.841	4.902
Min	0.563	0.576	0.592	0.606	0.905	1.111	1.307	1.852	2.000	2.198	2.326	2.703	4.878
Ave	0.548	0.570	0.585	0.592	0.885	1.067	1.286	1.695	1.852	2.105	2.260	2.469	4.348
Max	0.533	0.563	0.578	0.578	0.866	1.026	1.266	1.563	1.724	2.020	2.198	2.273	3.922
Min	0.469	0.480	0.493	0.505	0.754	0.926	1.089	1.543	1.667	1.832	1.938	2.252	4.065
Ave	0.457	0.475	0.487	0.493	0.737	0.889	1.072	1.412	1.543	1.754	1.883	2.058	3.623
Max	0.444	0.469	0.482	0.482	0.722	0.855	1.055	1.302	1.437	1.684	1.832	1.894	3.268
Min	0.402	0.412	0.423	0.433	0.646	0.794	0.934	1.323	1.429	1.570	1.661	1.931	3.484
Ave	0.391	0.407	0.418	0.423	0.632	0.762	0.919	1.211	1.323	1.504	1.614	1.764	3.106
Max	0.381	0.402	0.413	0.413	0.618	0.733	0.904	1.116	1.232	1.443	1.570	1.623	2.801
Min	0.352	0.360	0.370	0.379	0.566	0.694	0.817	1.157	1.250	1.374	1.453	1.689	3.049
Ave	0.342	0.356	0.365	0.370	0.553	0.667	0.804	1.059	1.157	1.316	1.412	1.543	2.717
Max	0.333	0.352	0.361	0.361	0.541	0.641	0.791	0.977	1.078	1.263	1.374	1.420	2.451

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Figure 3a

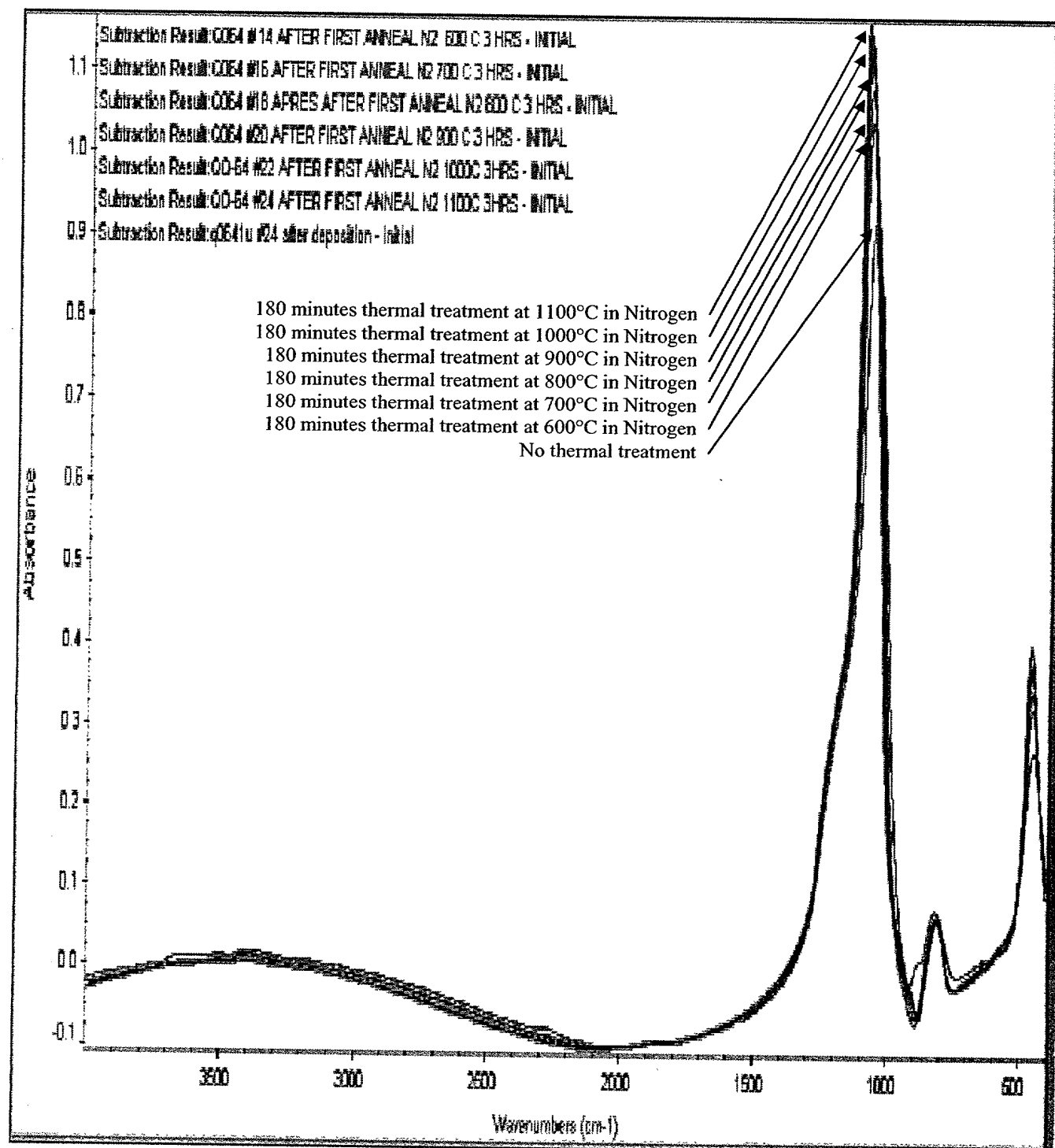


Figure 3b

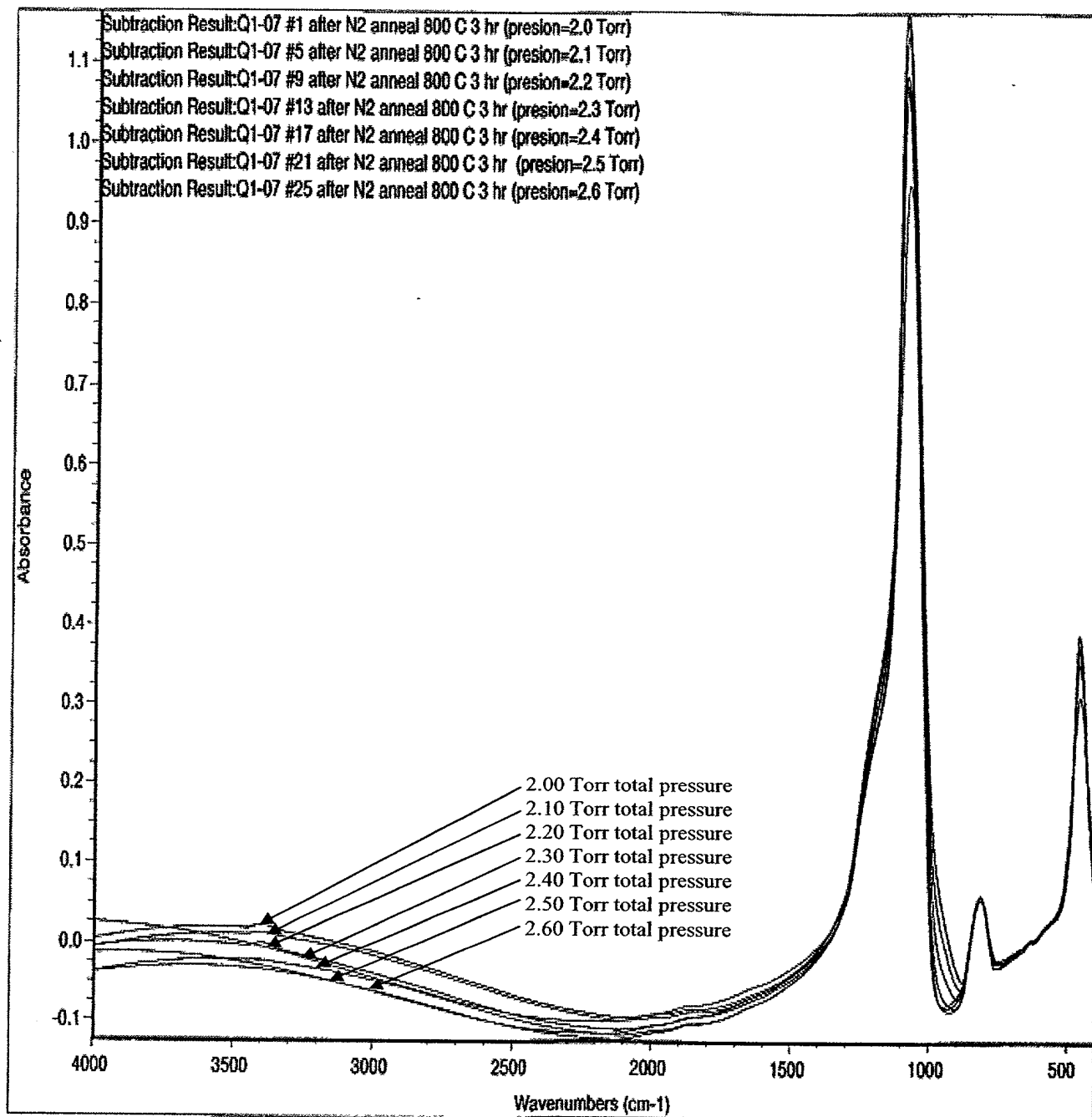


Figure 3c

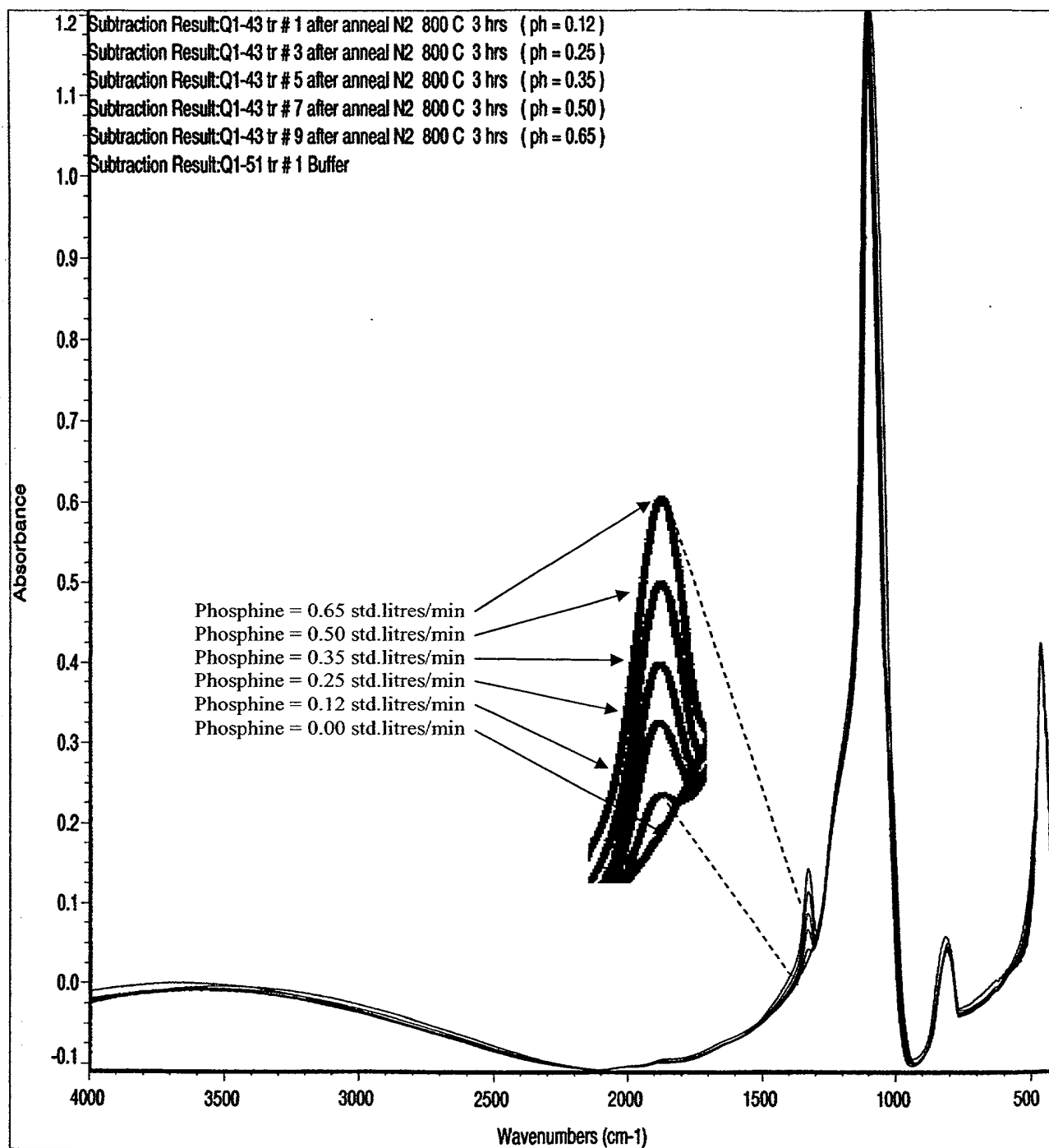


Figure 3d

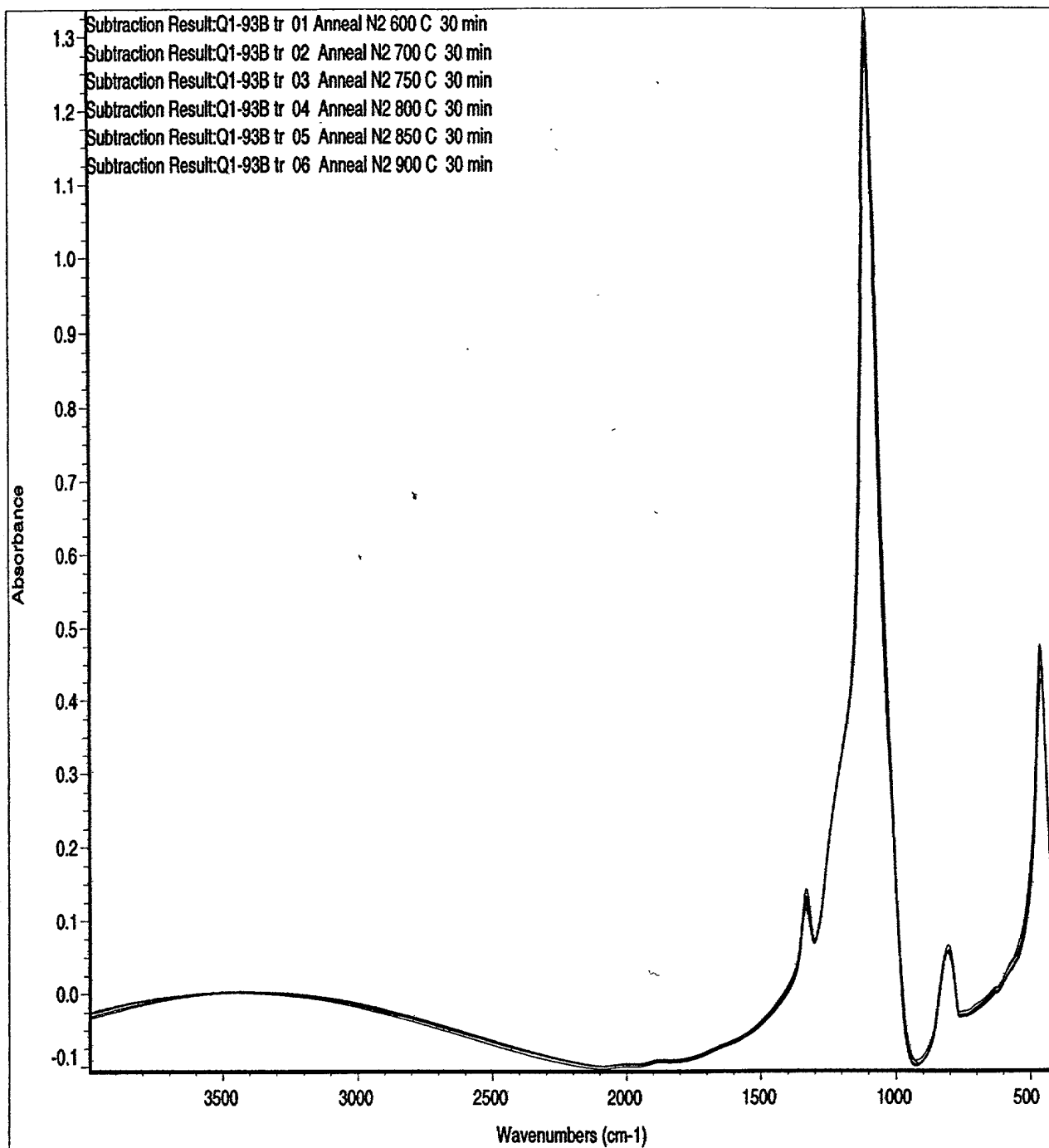


Figure 4a

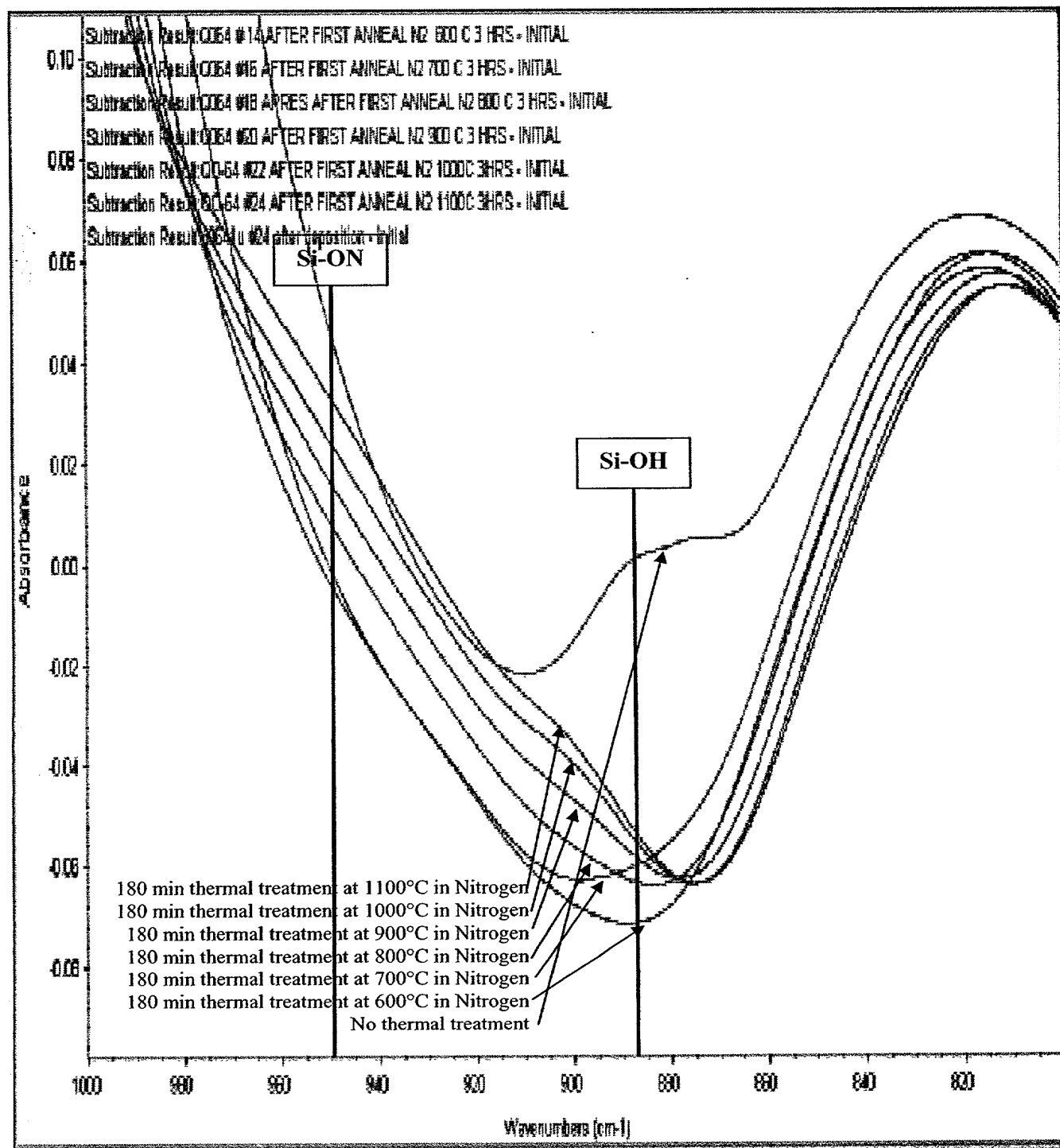


Figure 4b

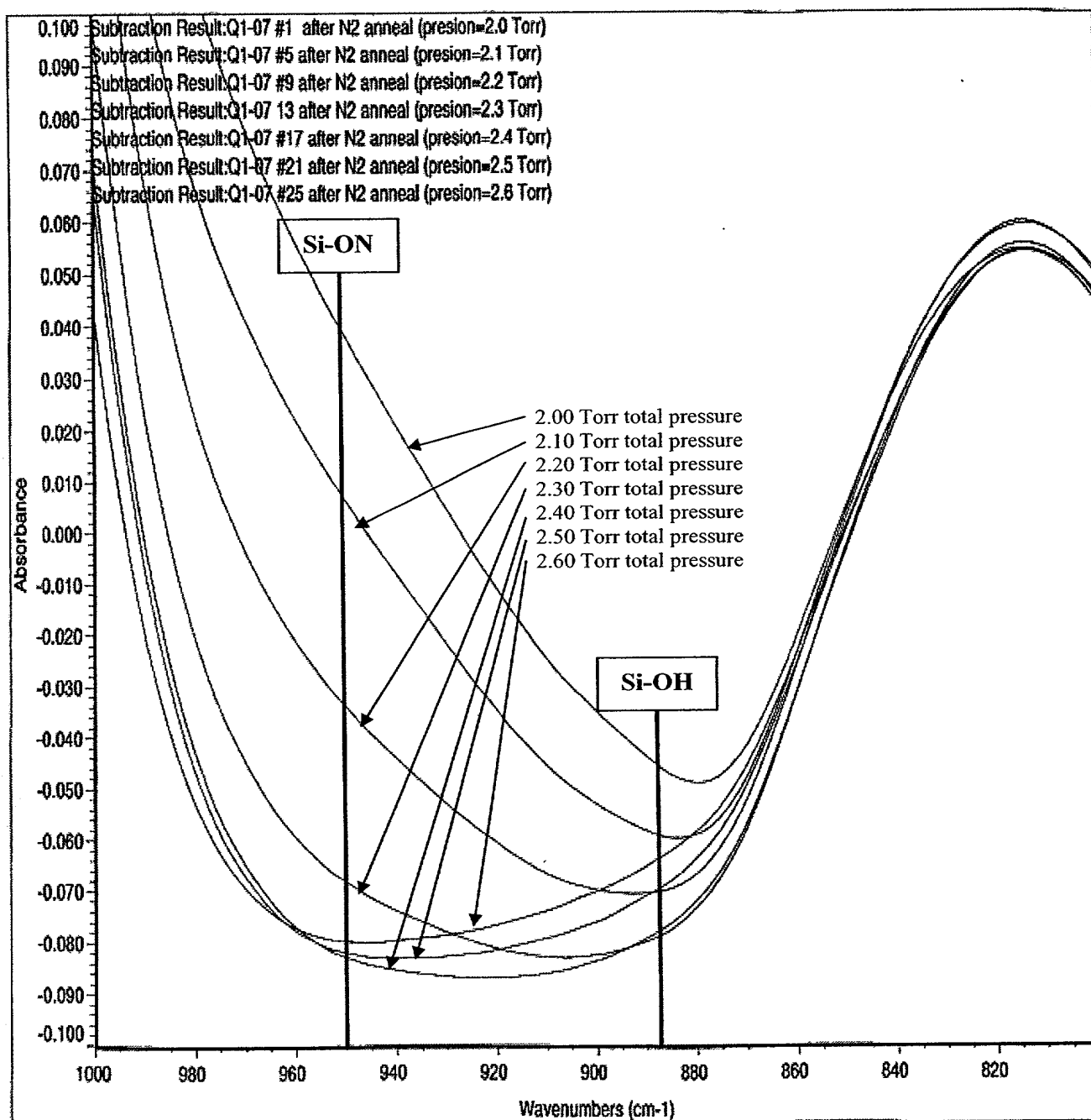


Figure 4c

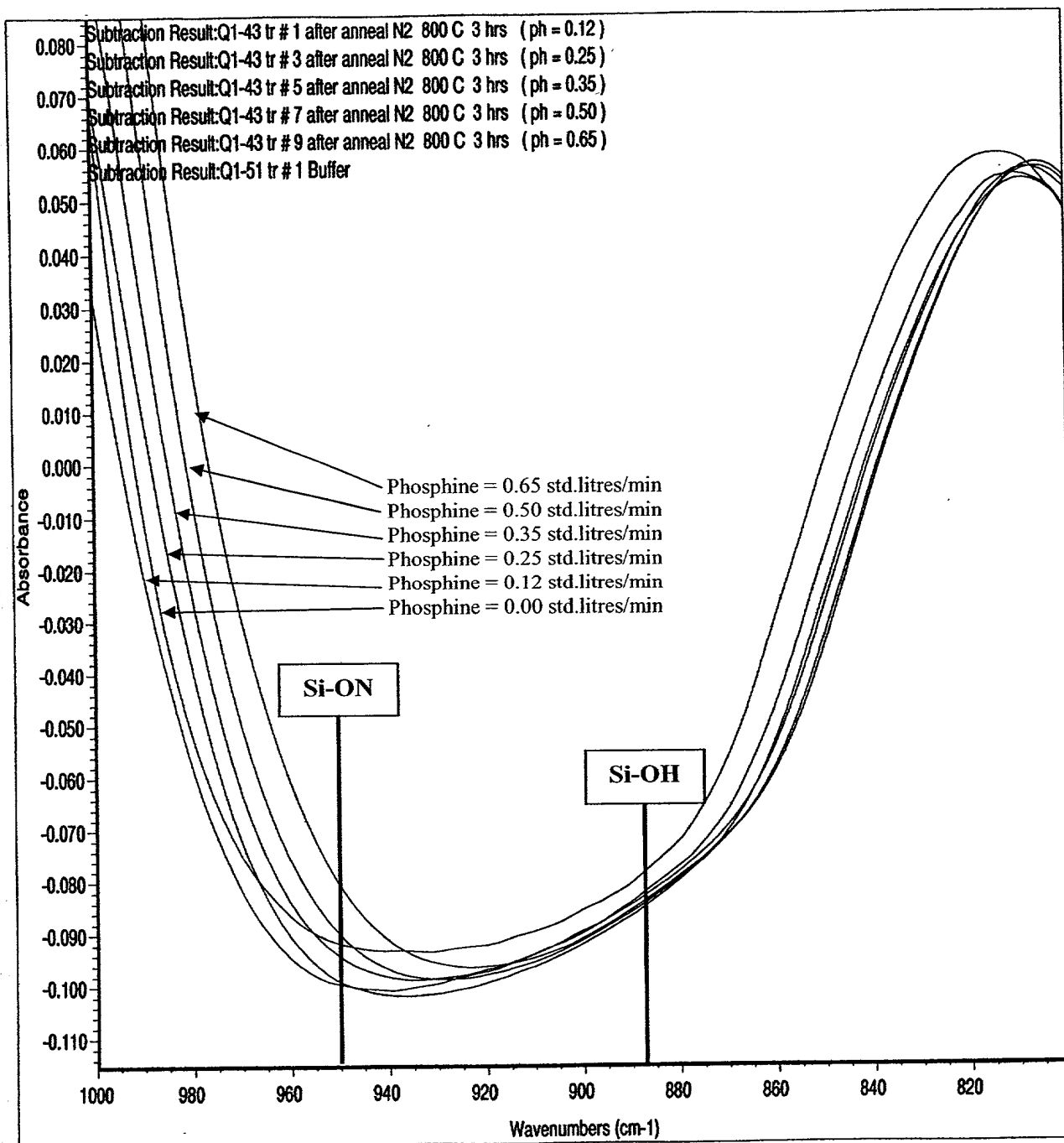


Figure 4d

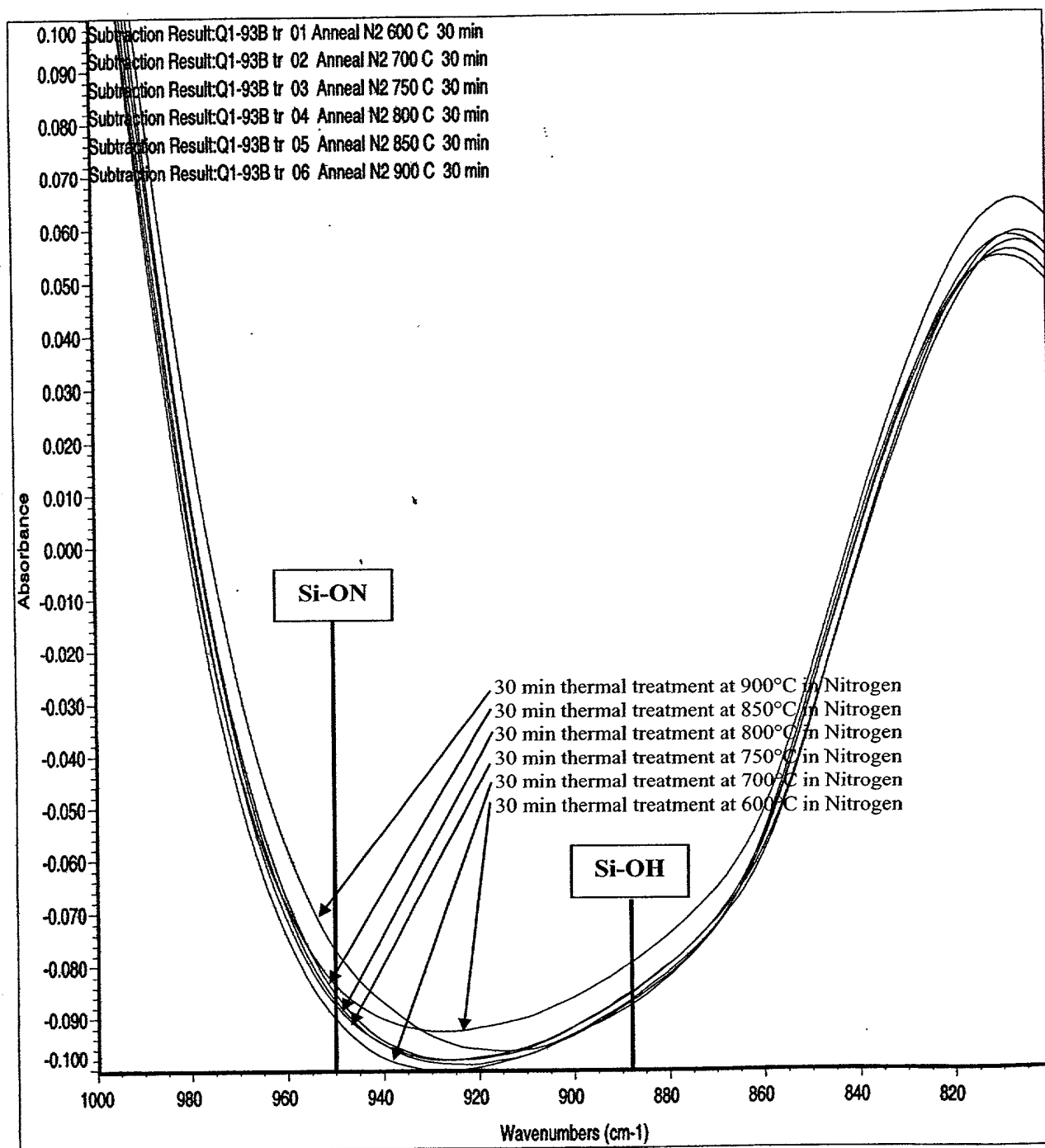


Figure 5c

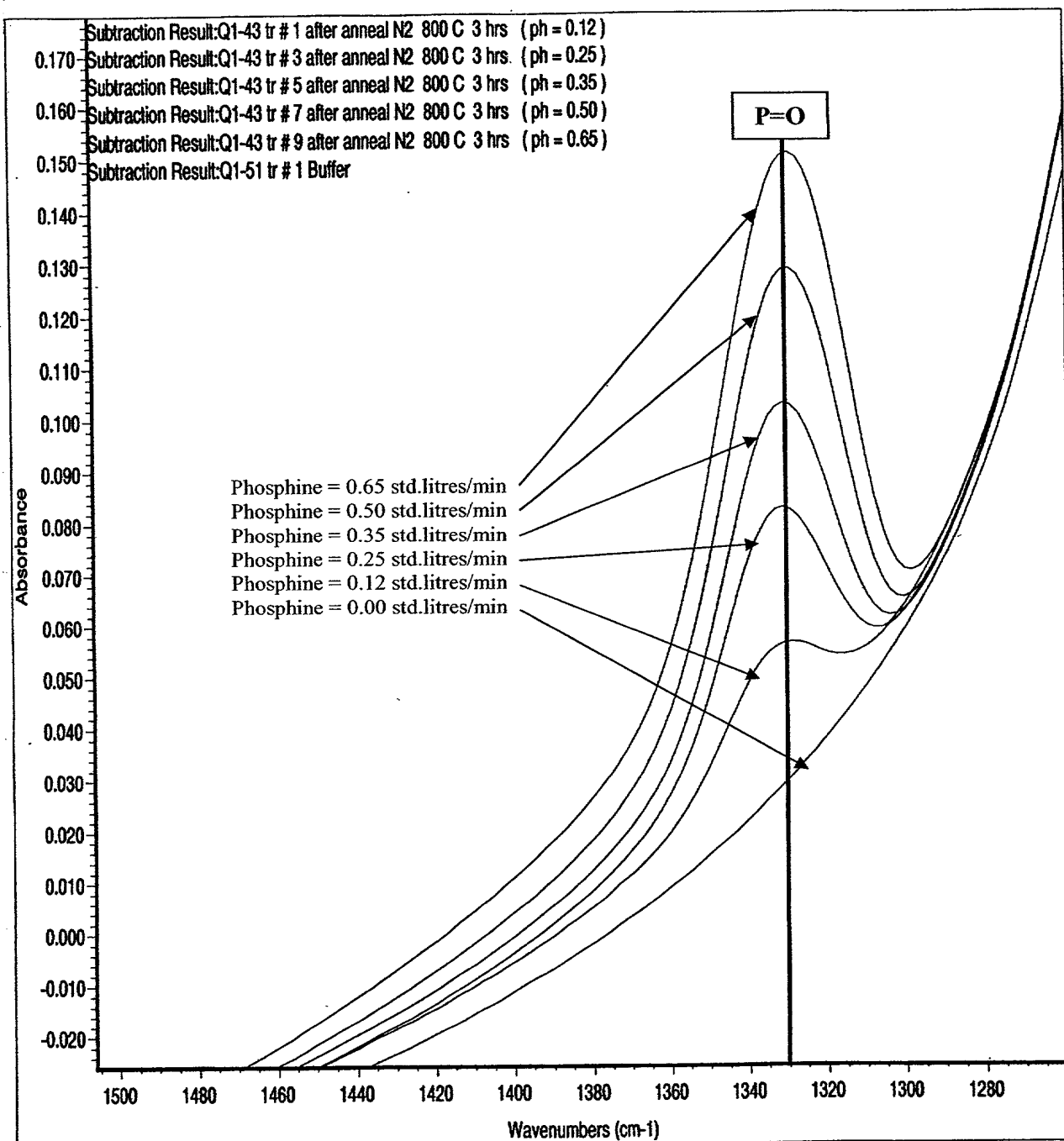


Figure 5d

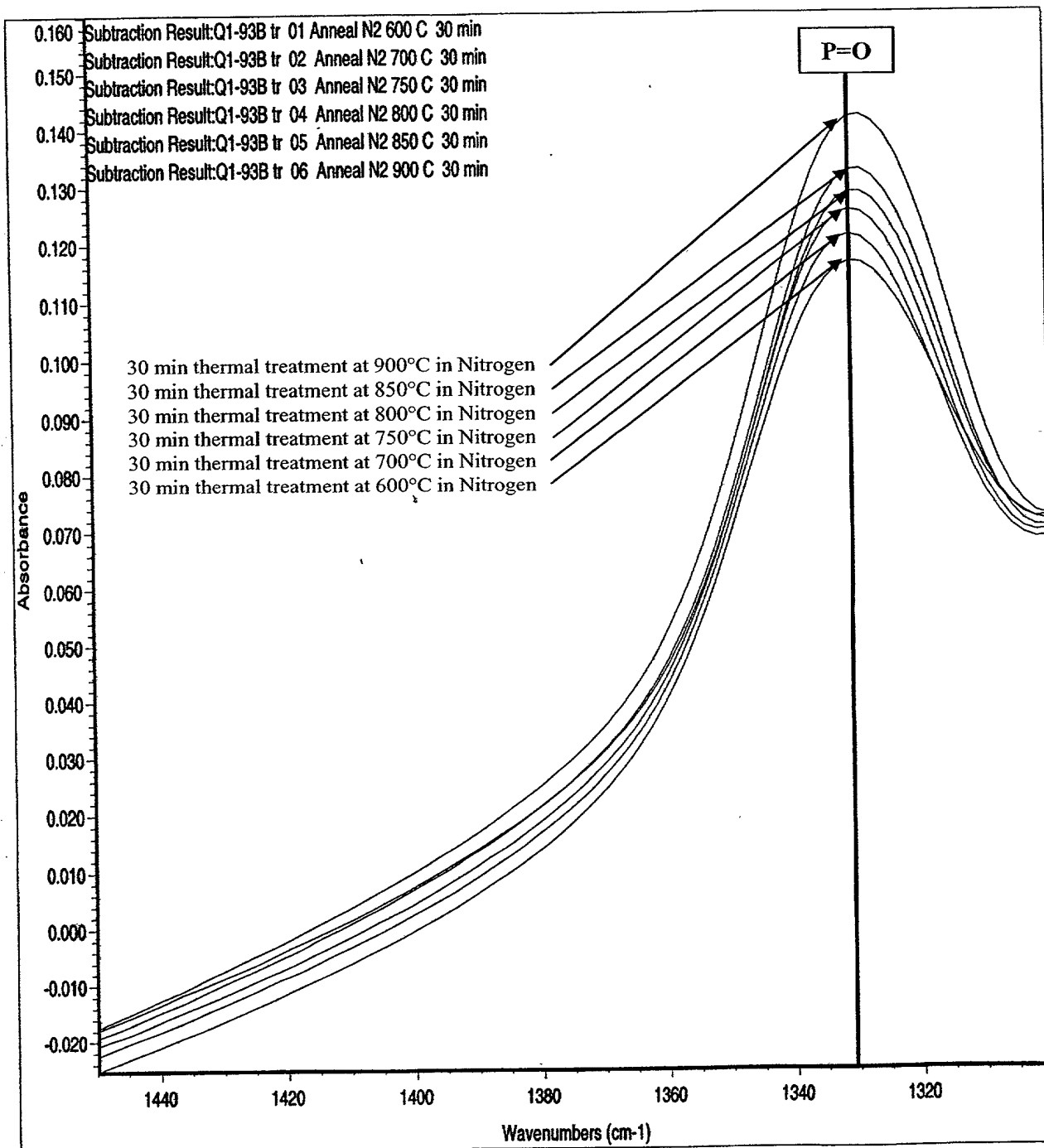


Figure 6a

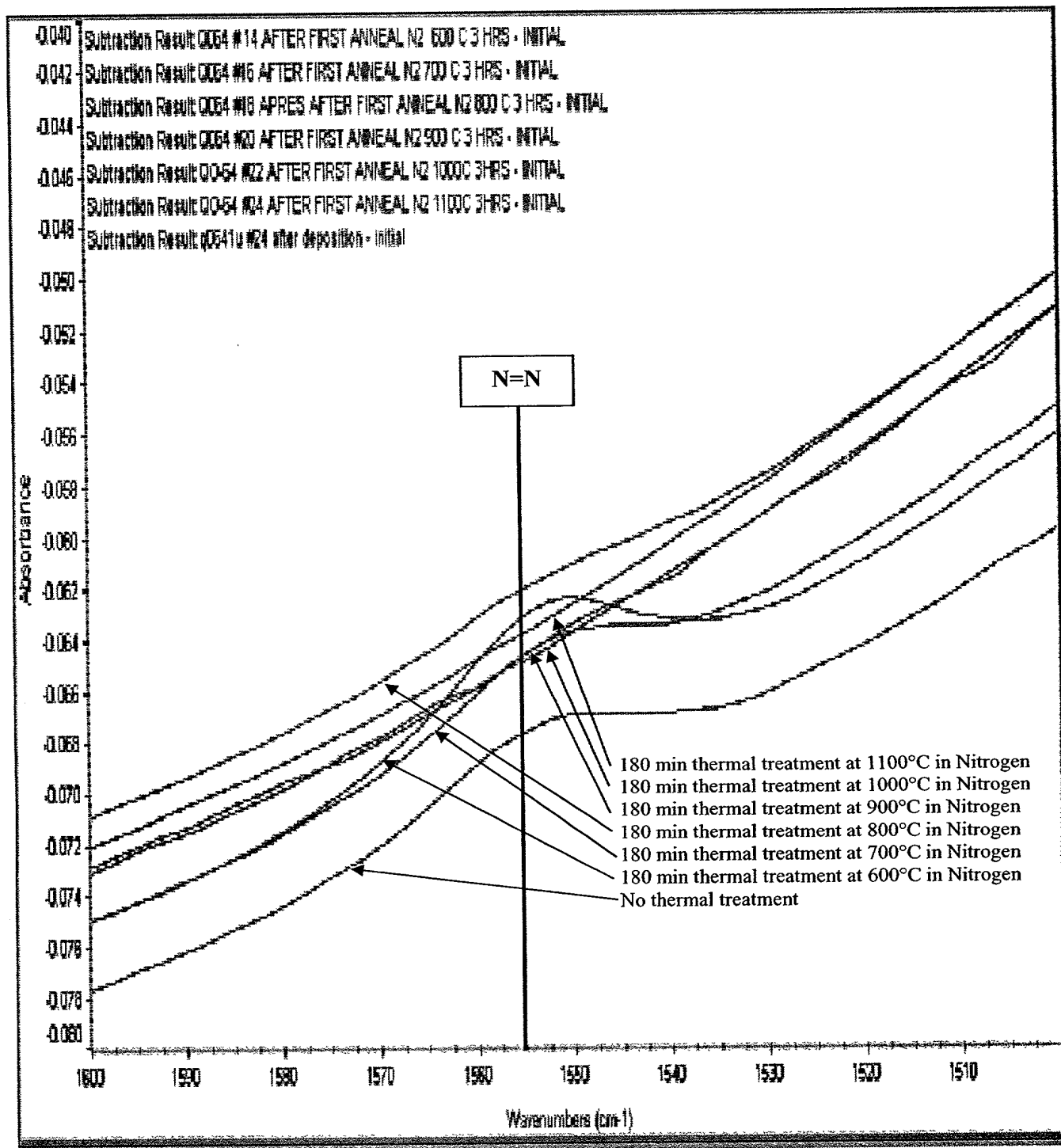


Figure 6b

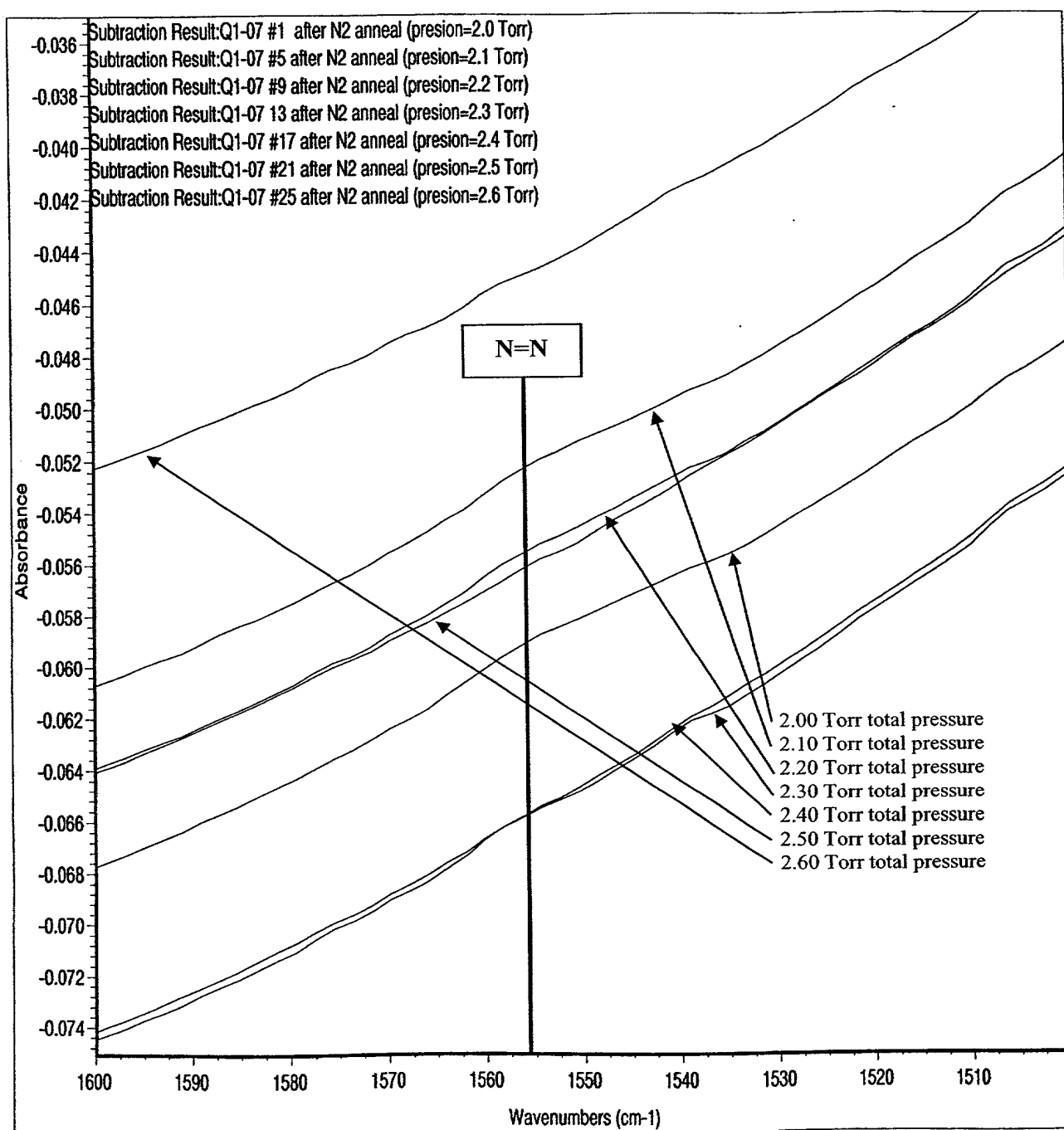


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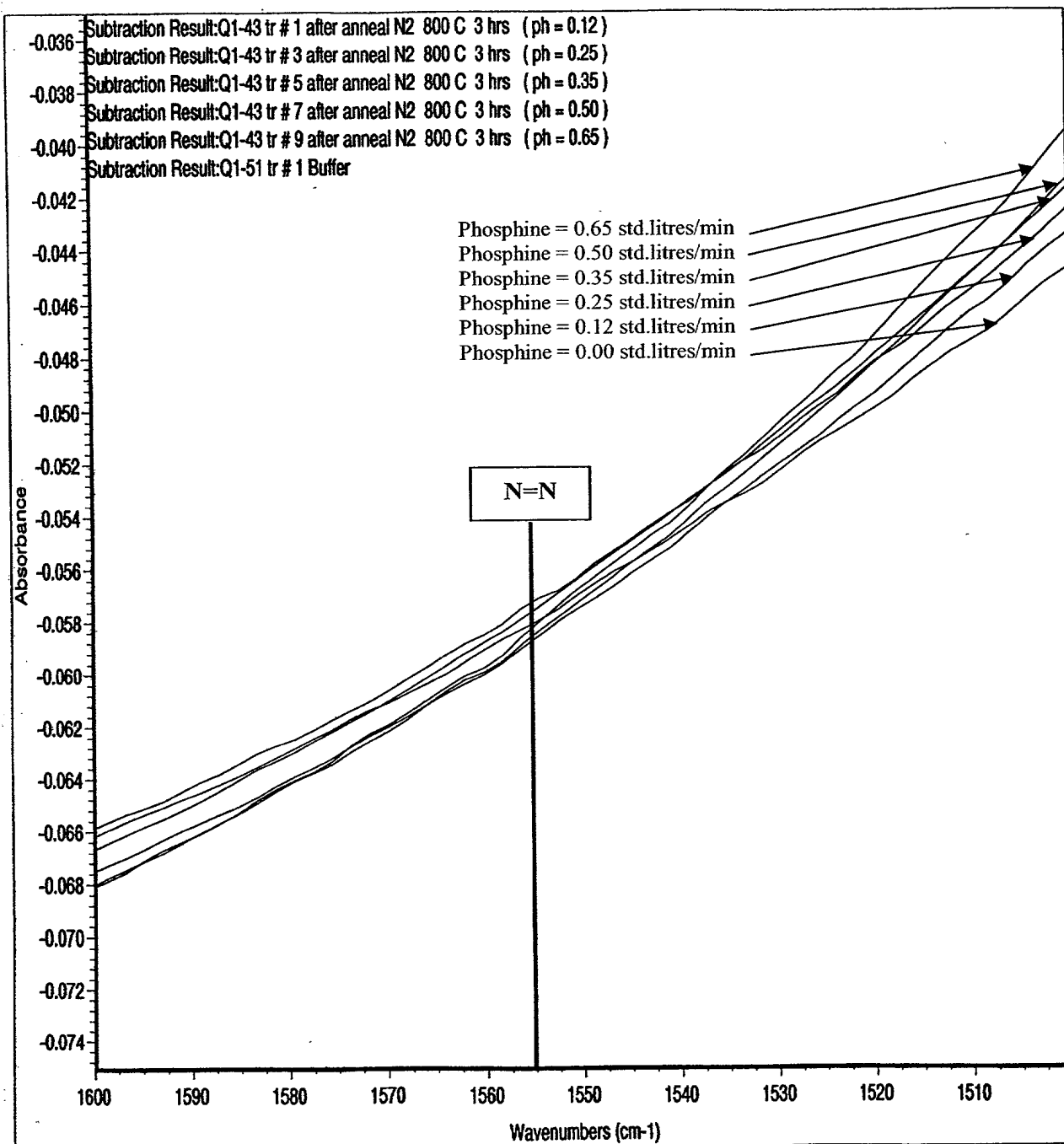


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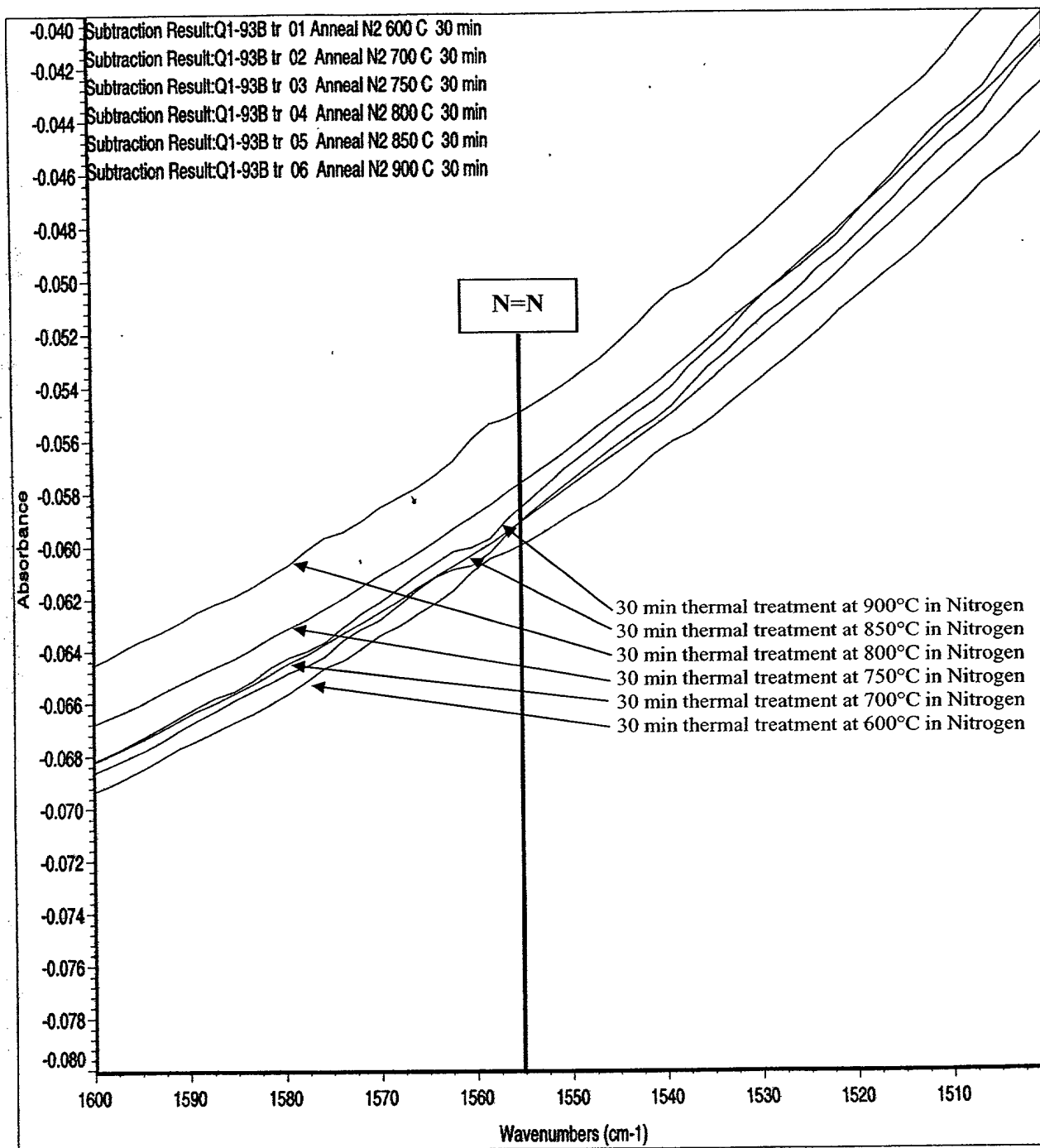


Figure 7a

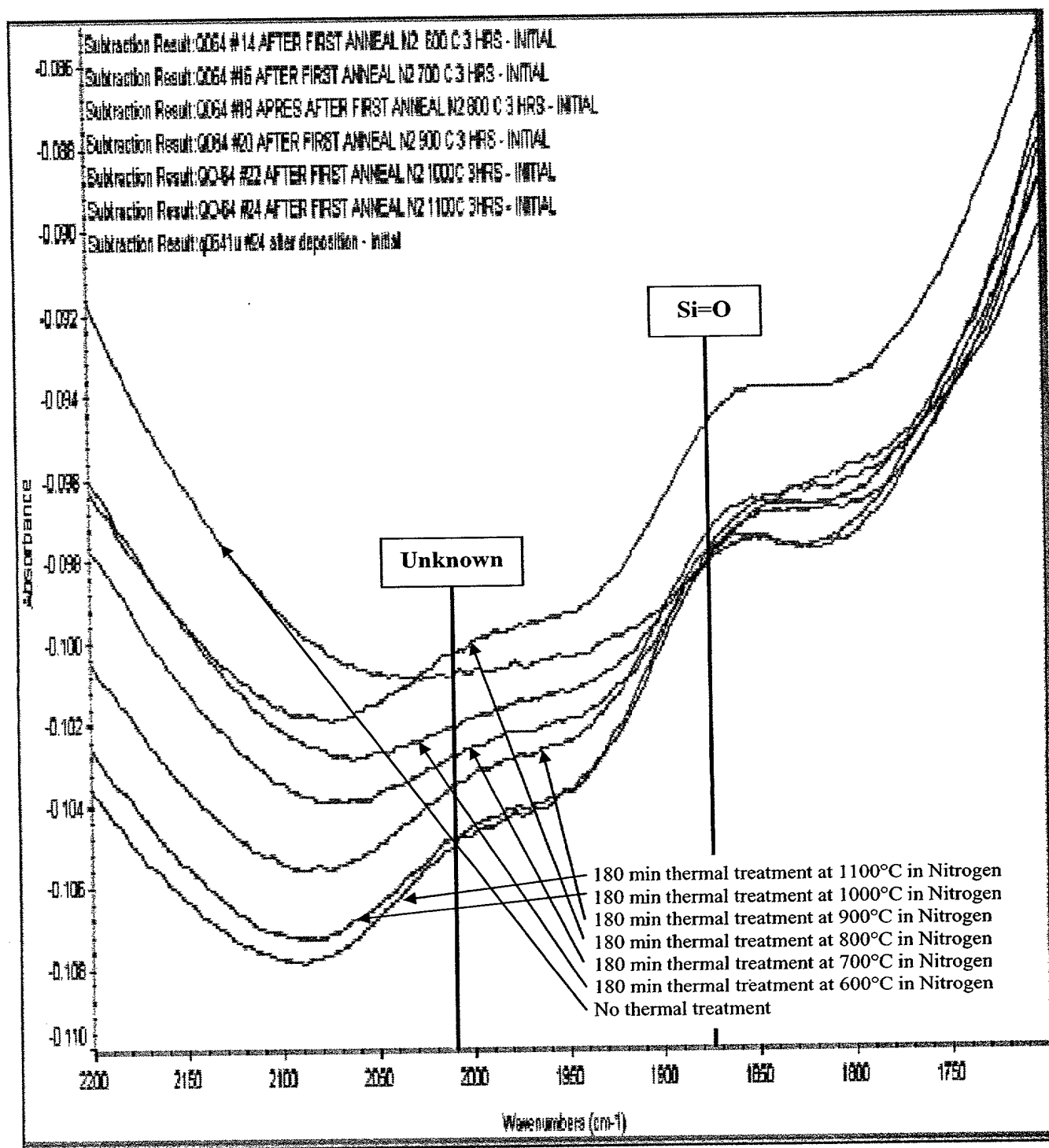


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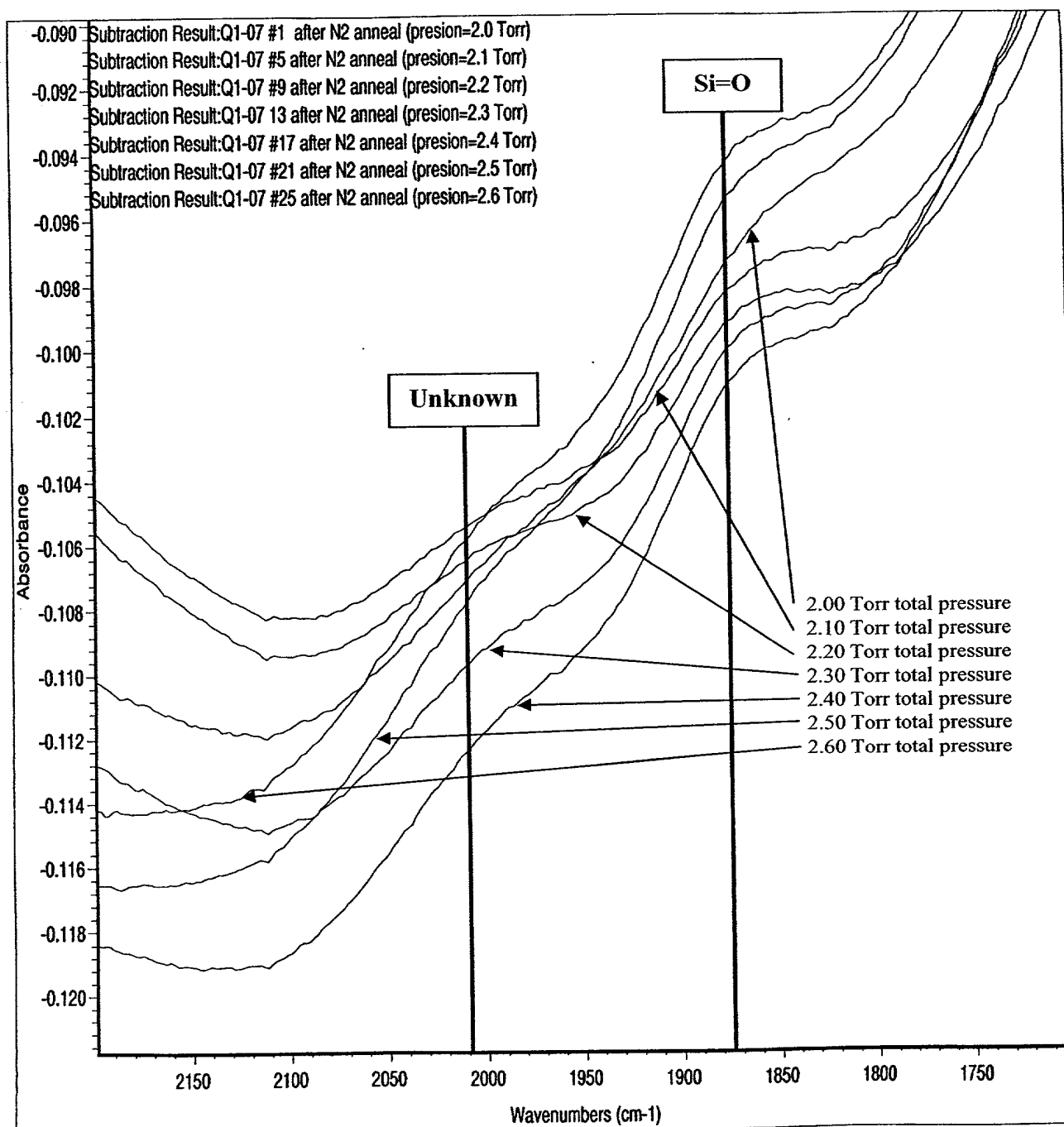


Figure 7c

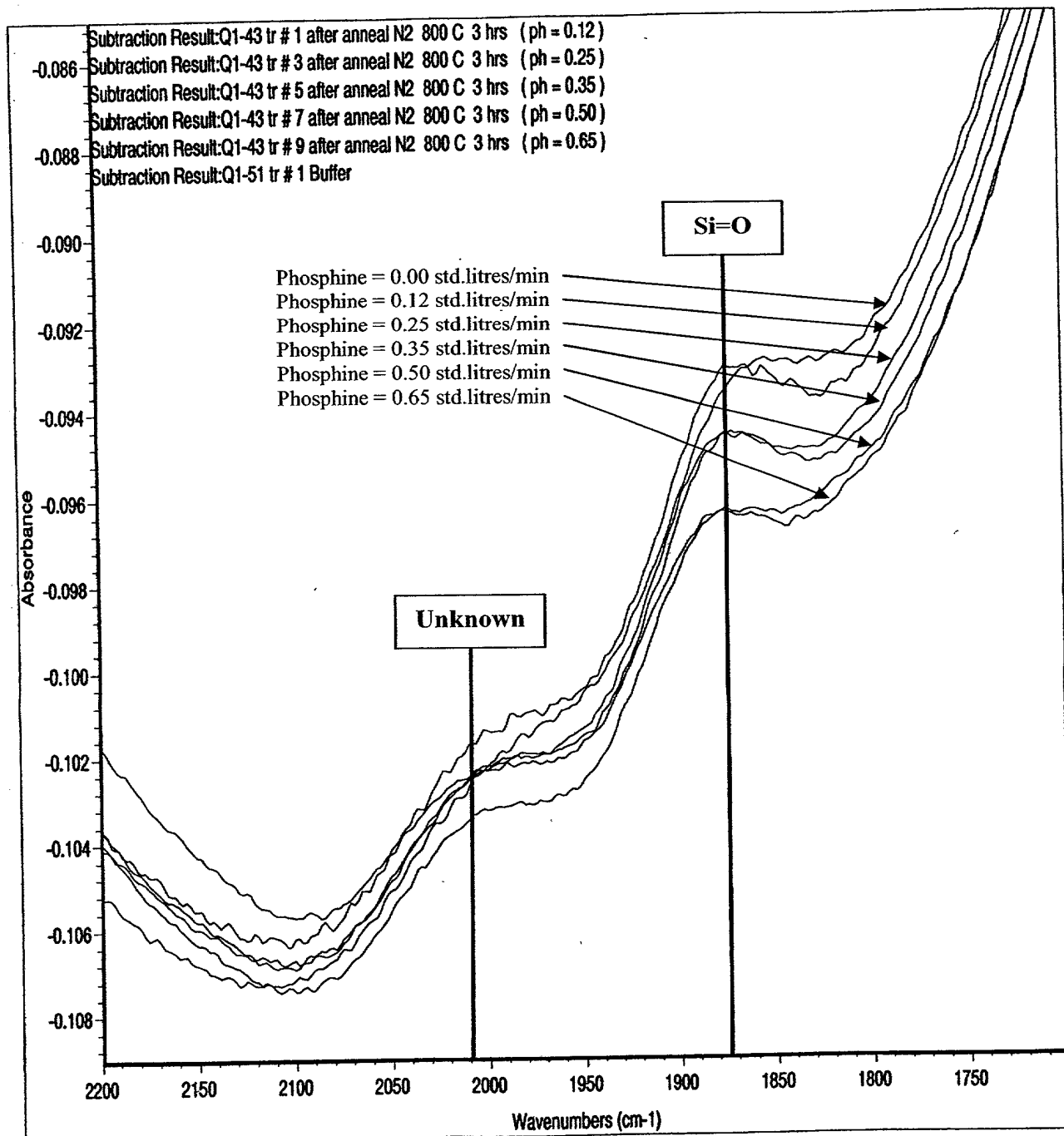


Figure 7d

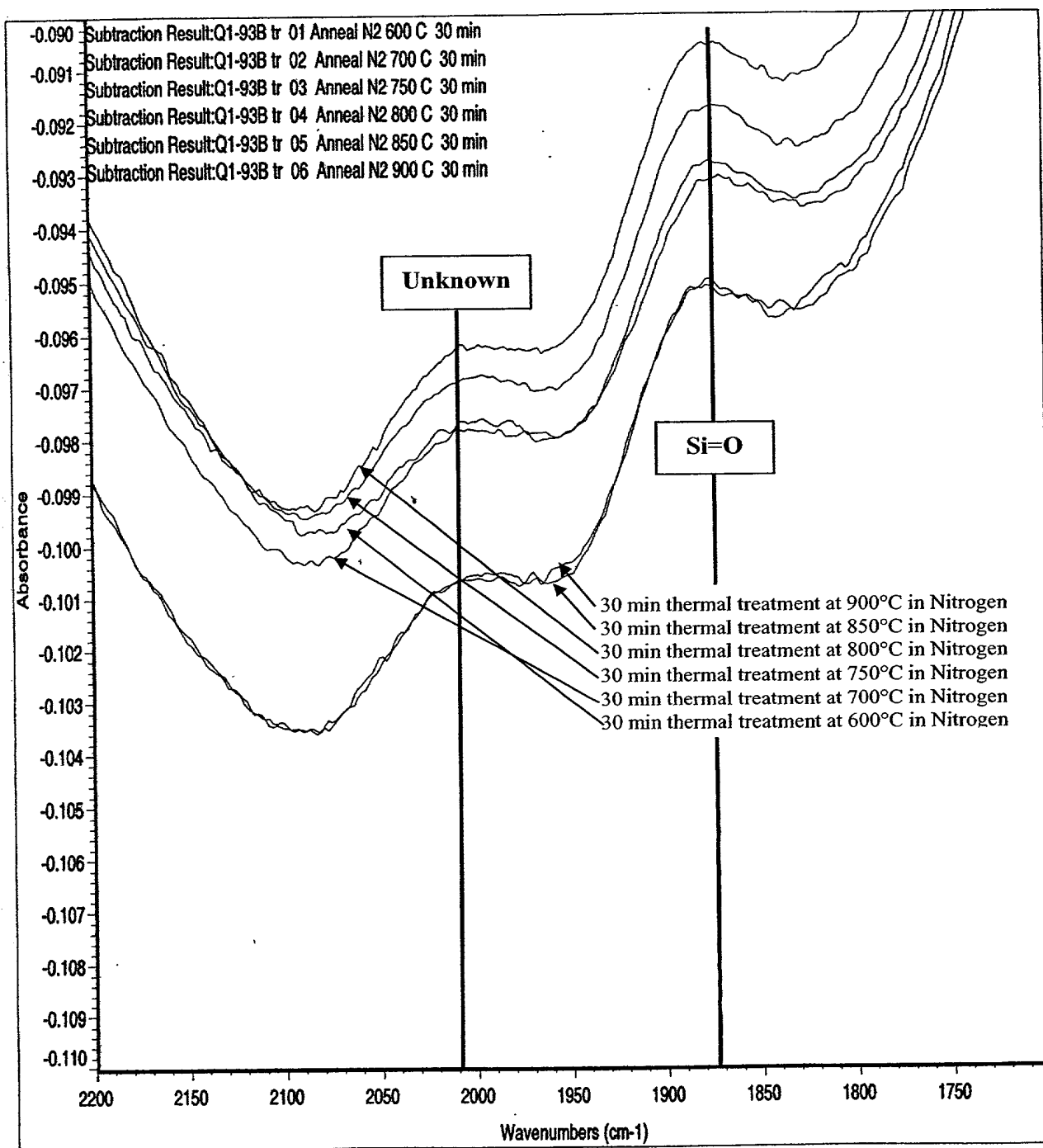


Figure 8a

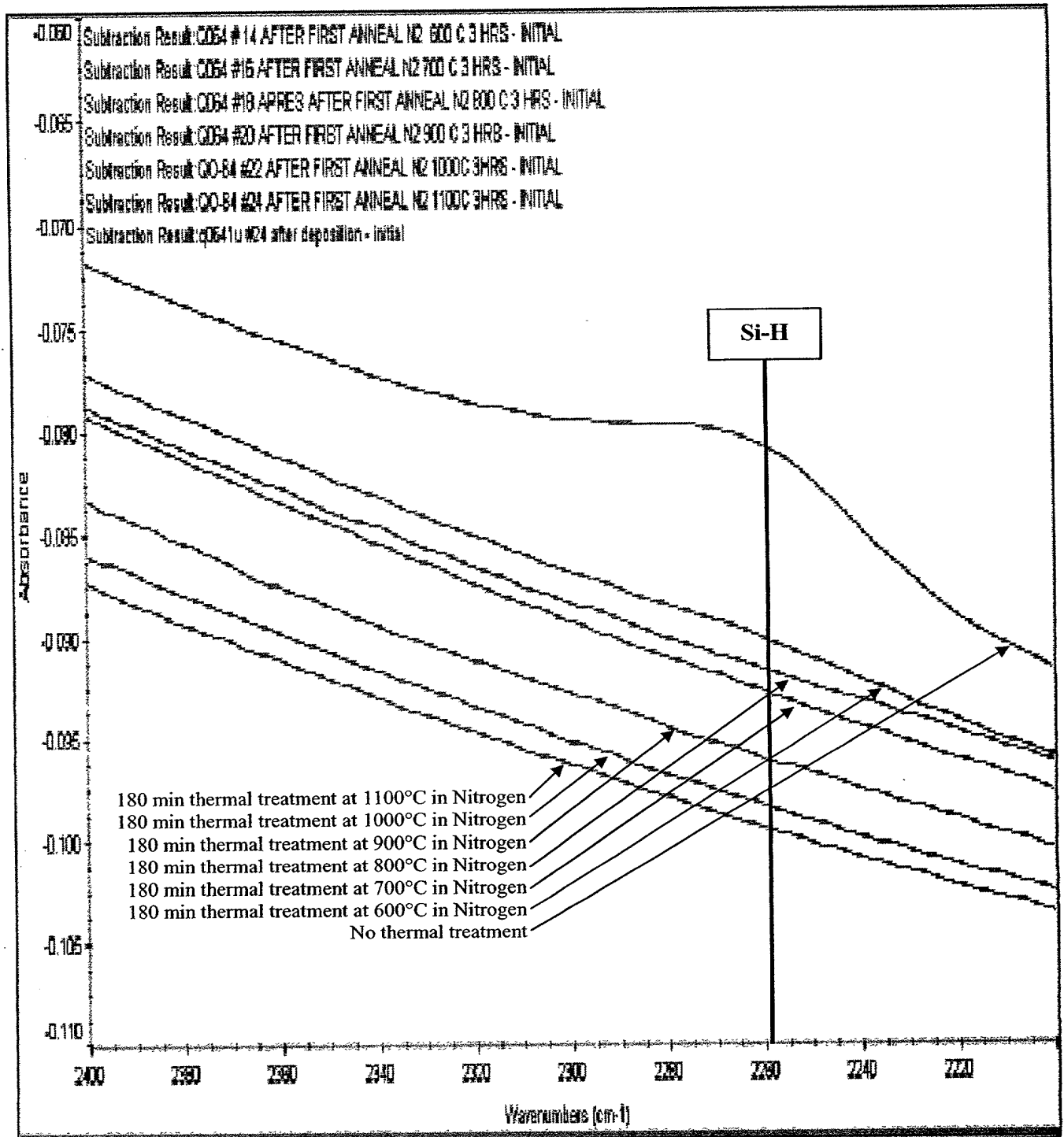


Figure 8b

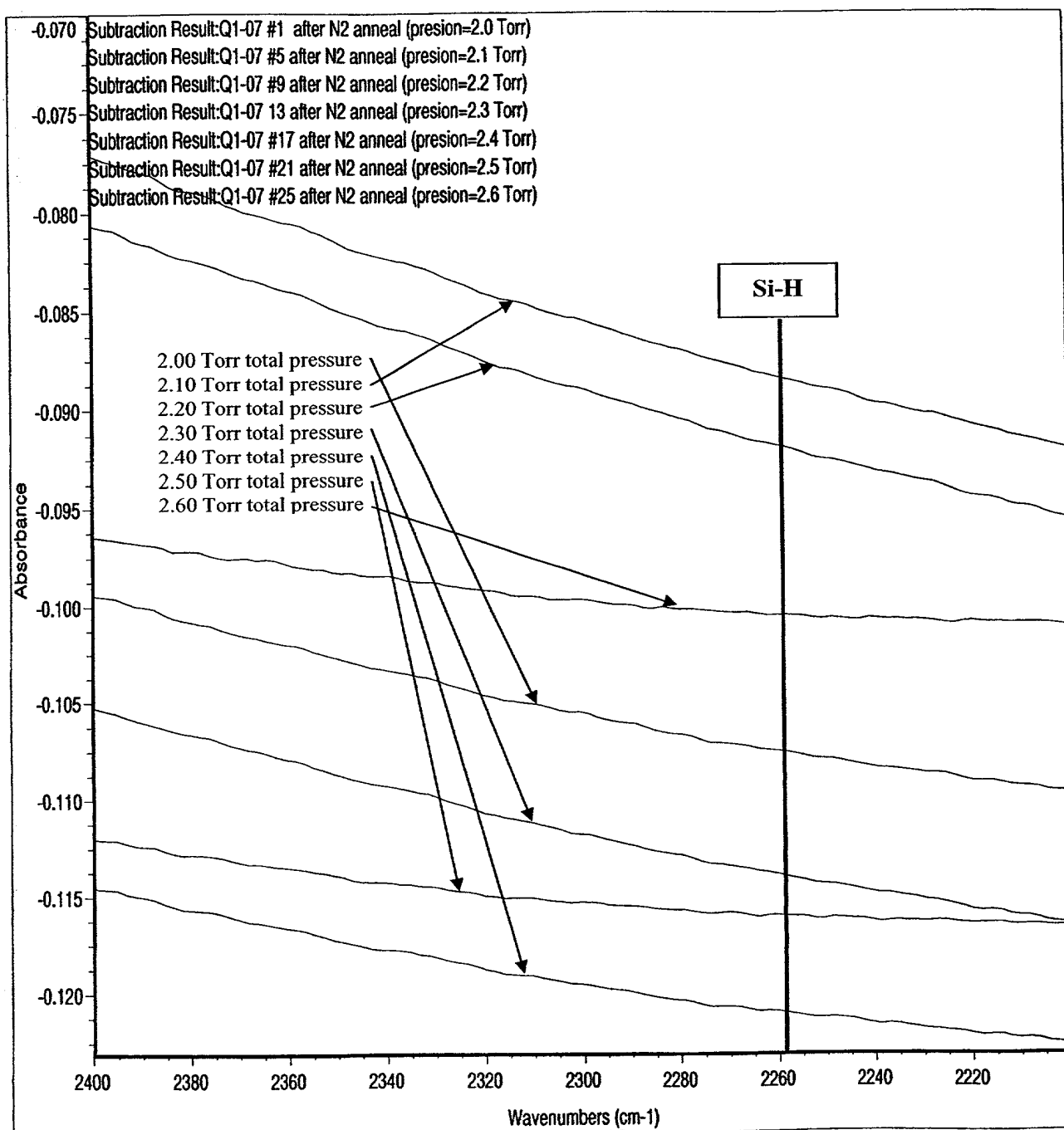


Figure 8c

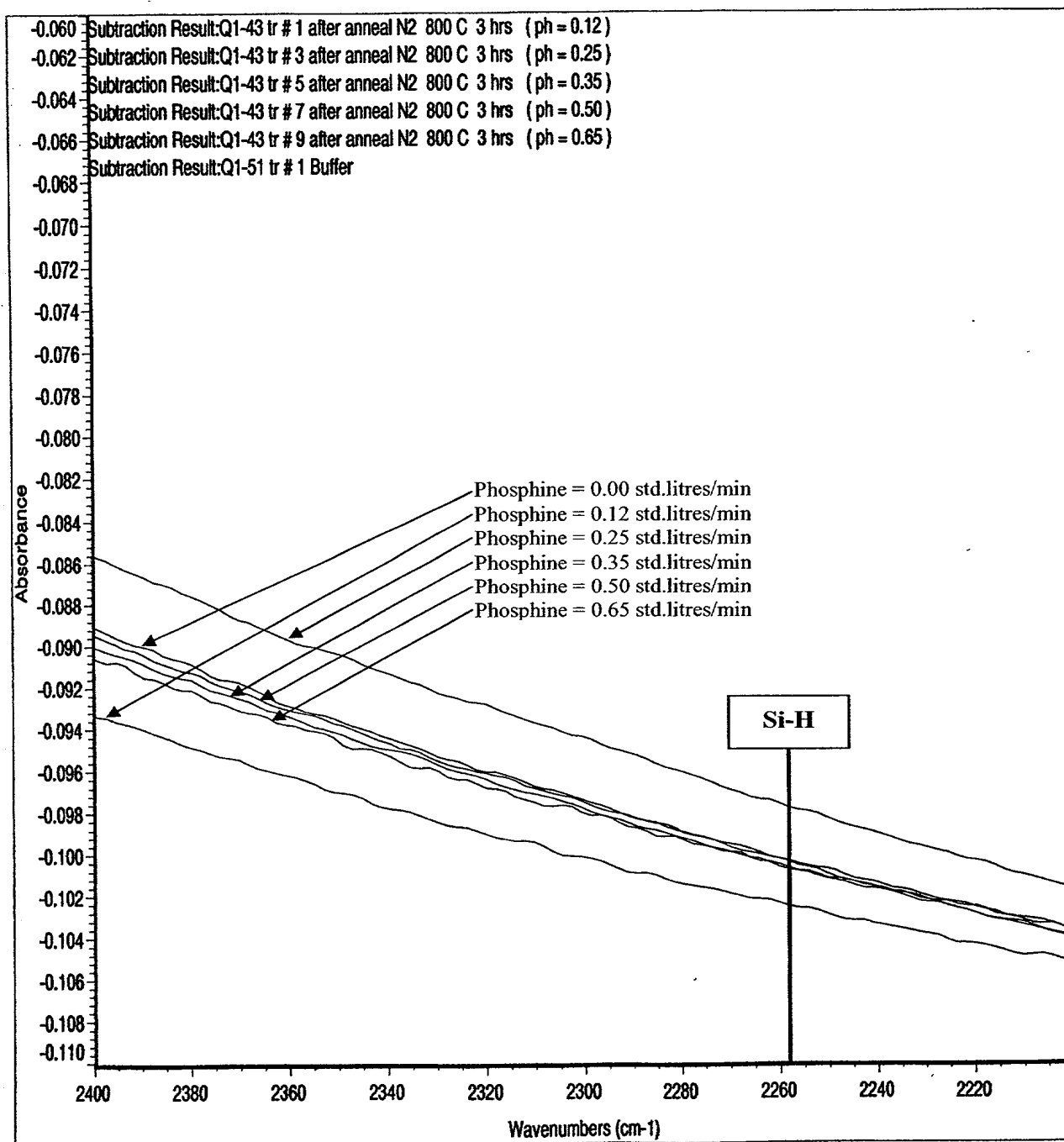


Figure 8d

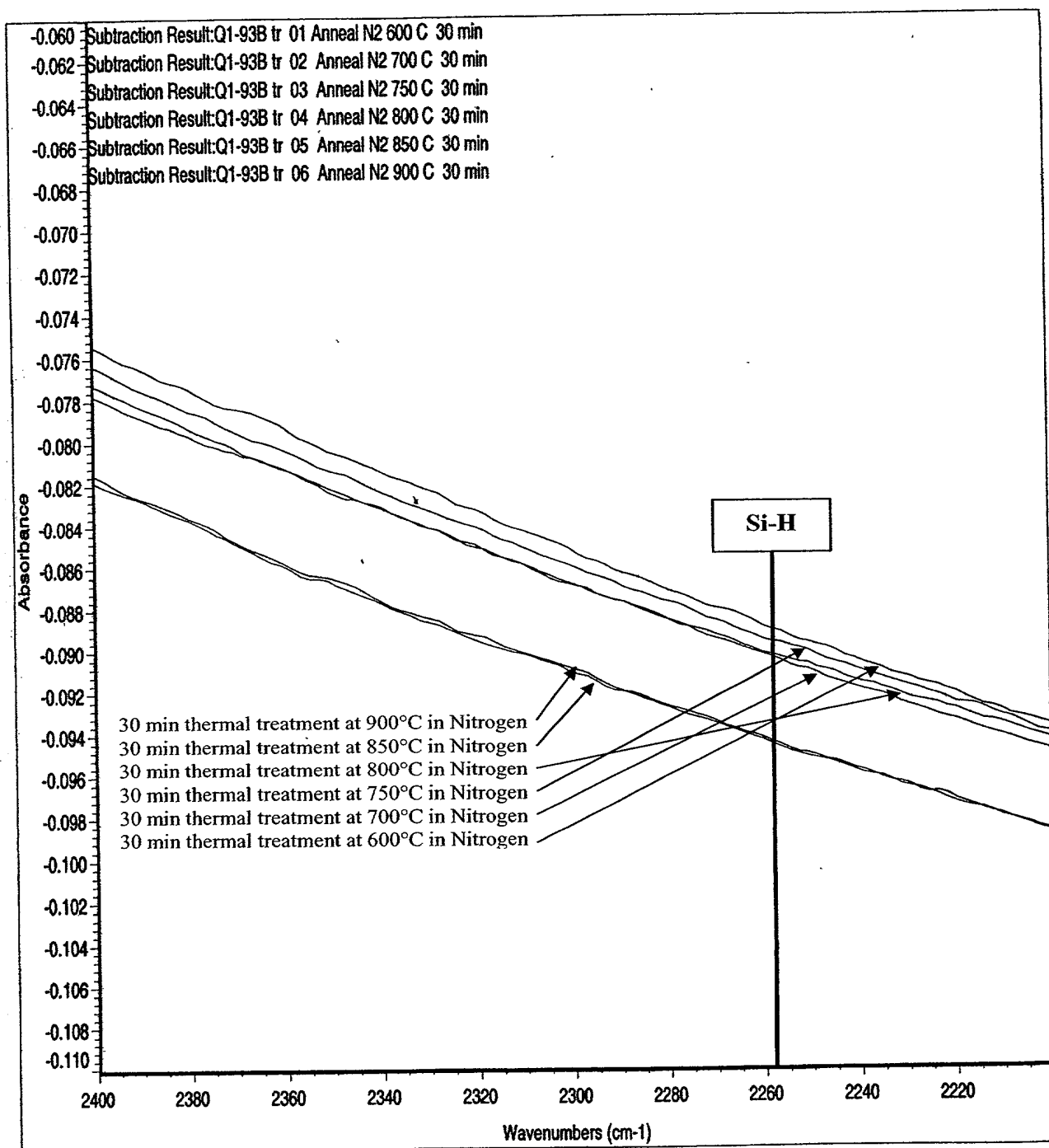


Figure 9a

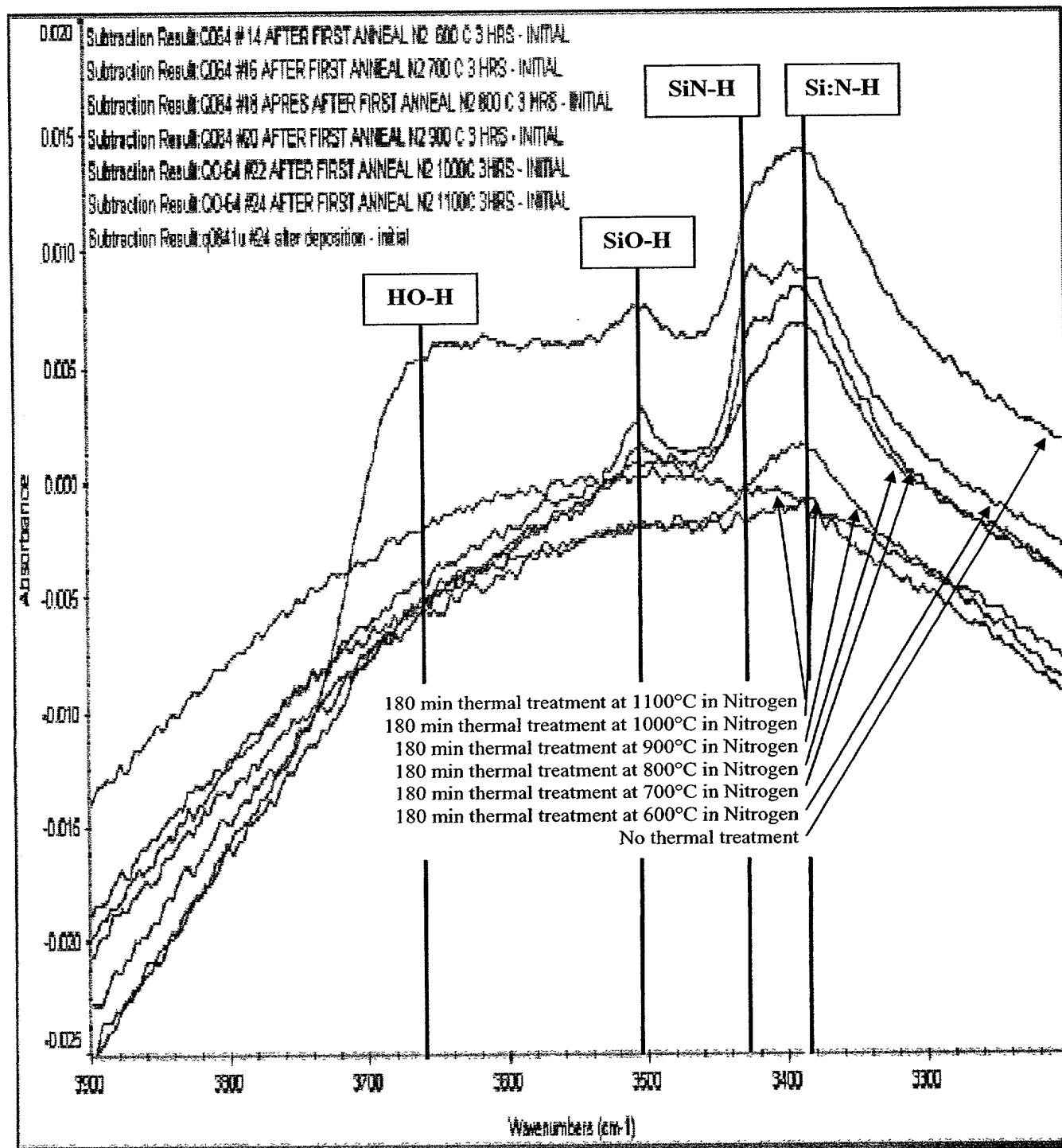


Figure 9b

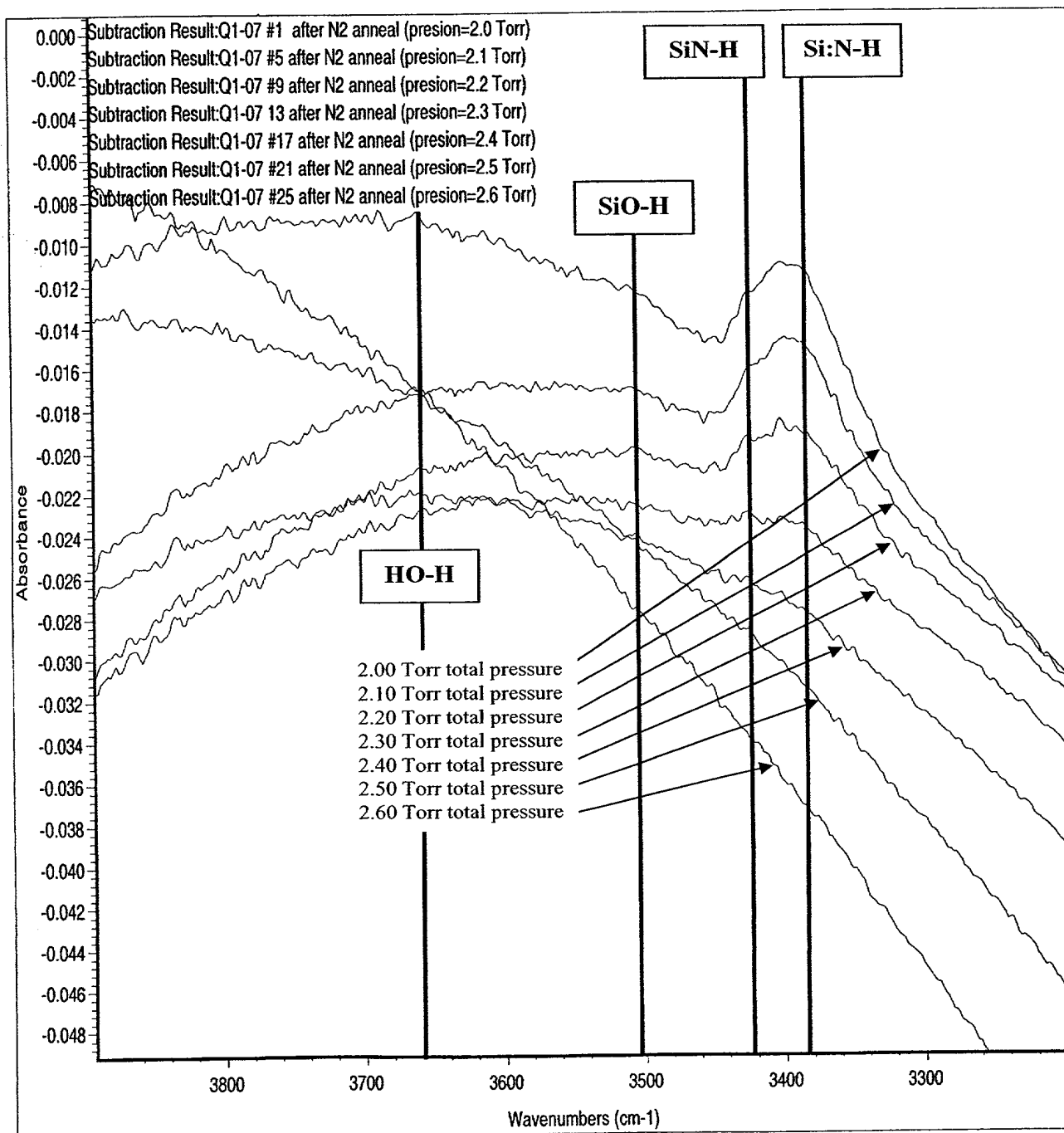


Figure 9c

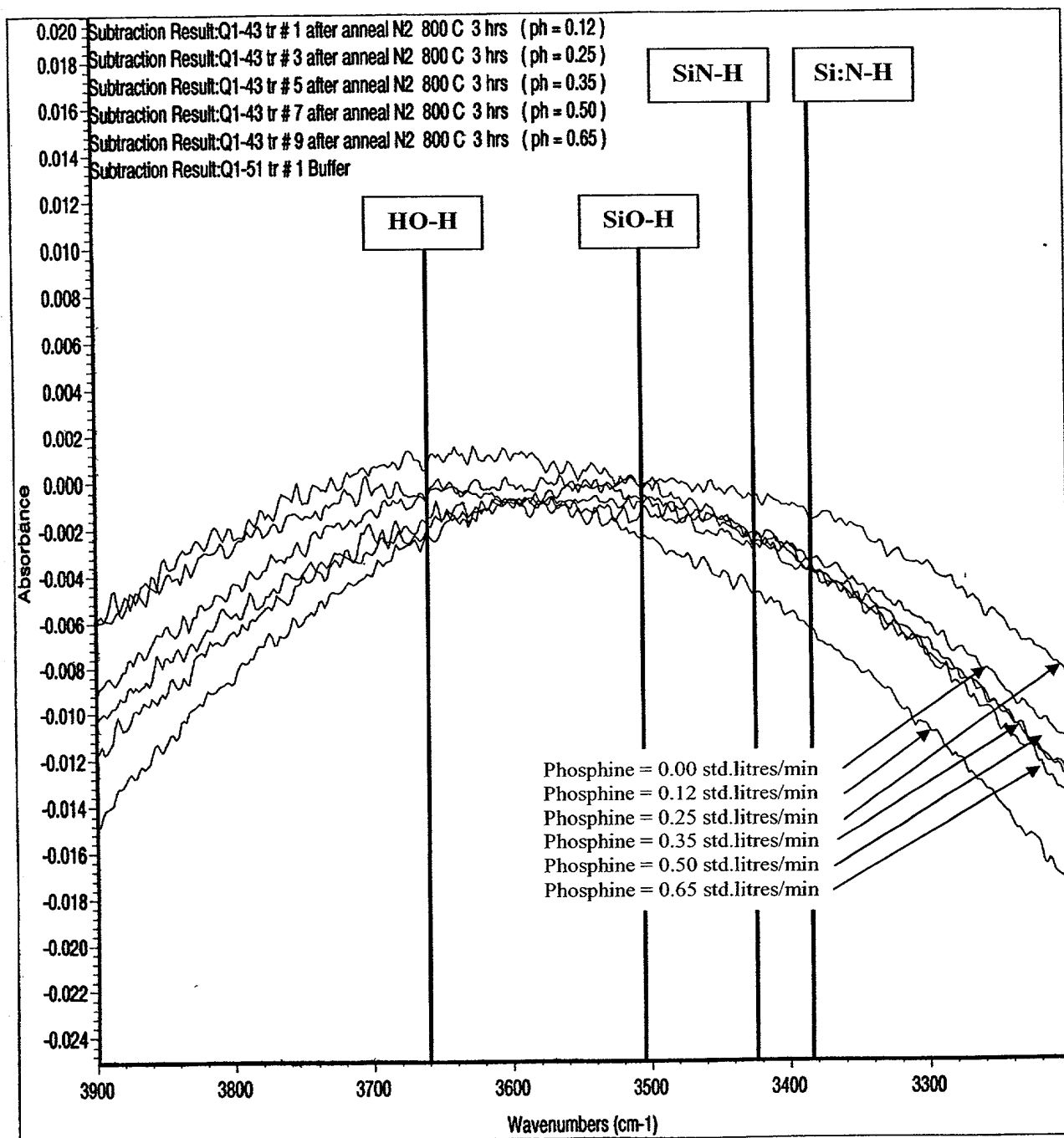


Figure 9d

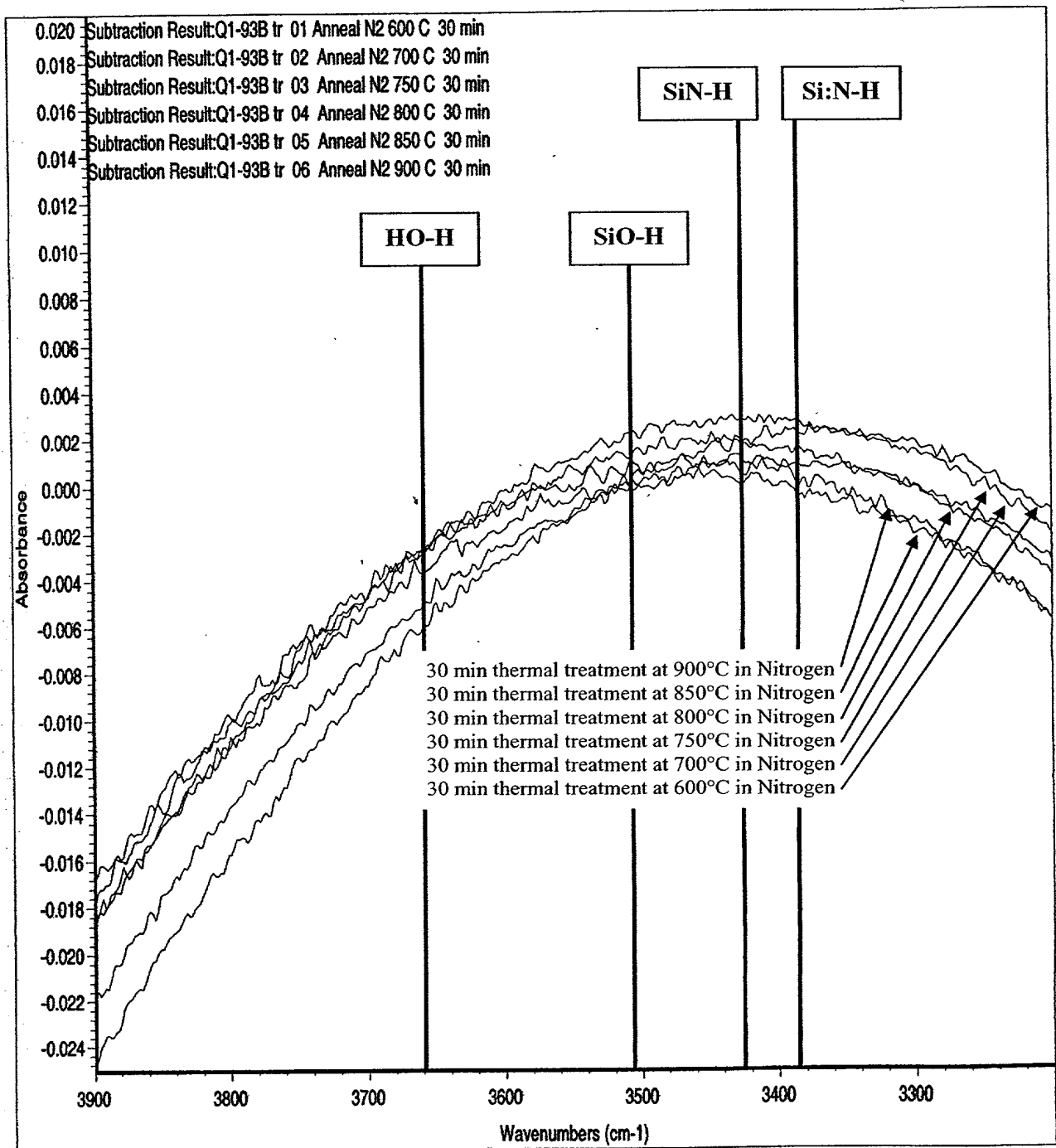


Figure 10

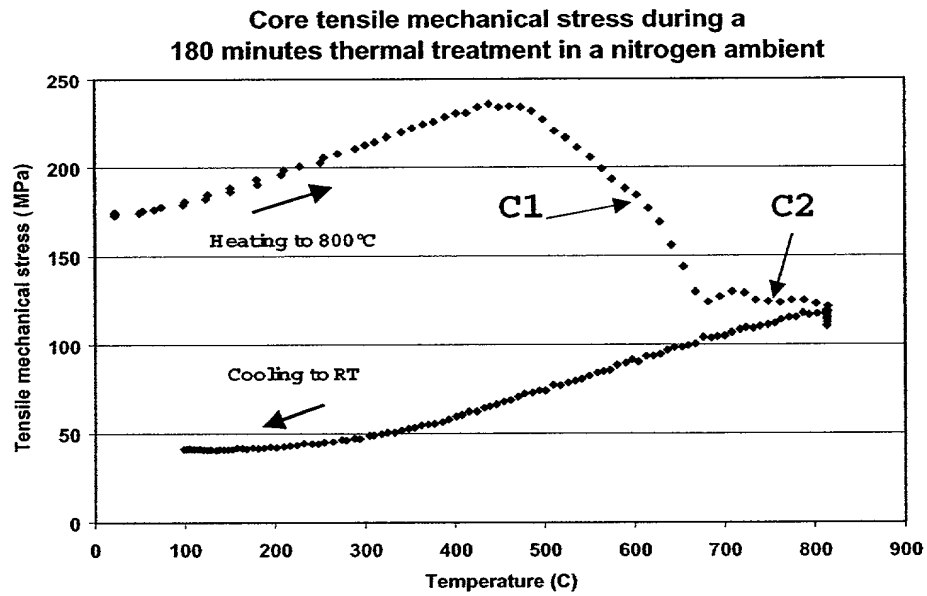
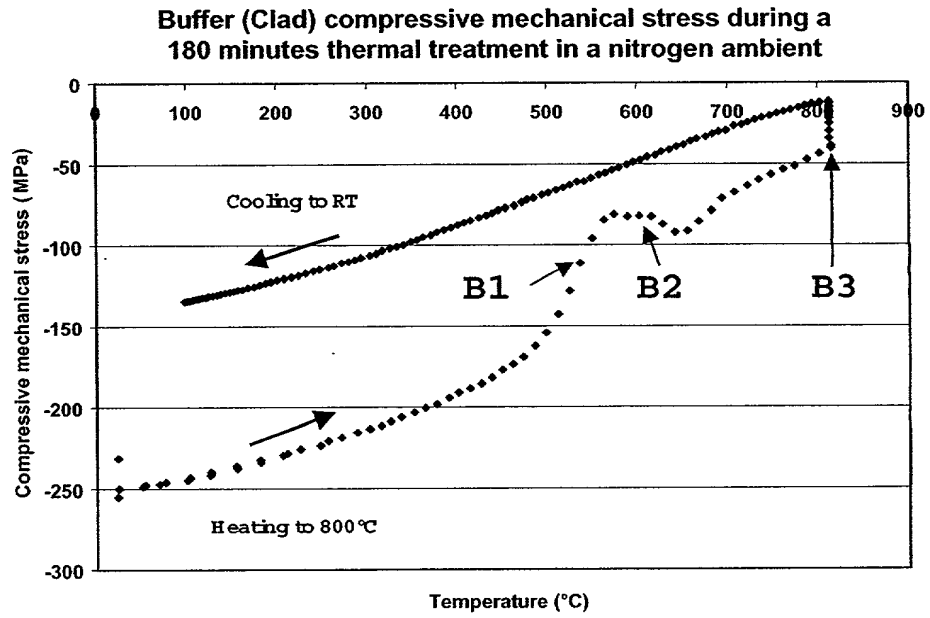


Figure 11

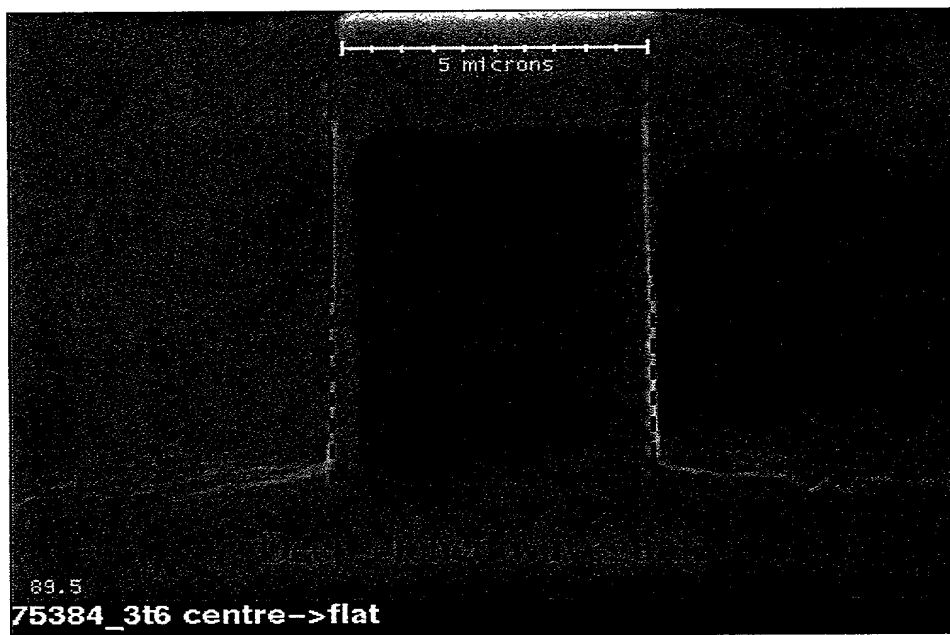
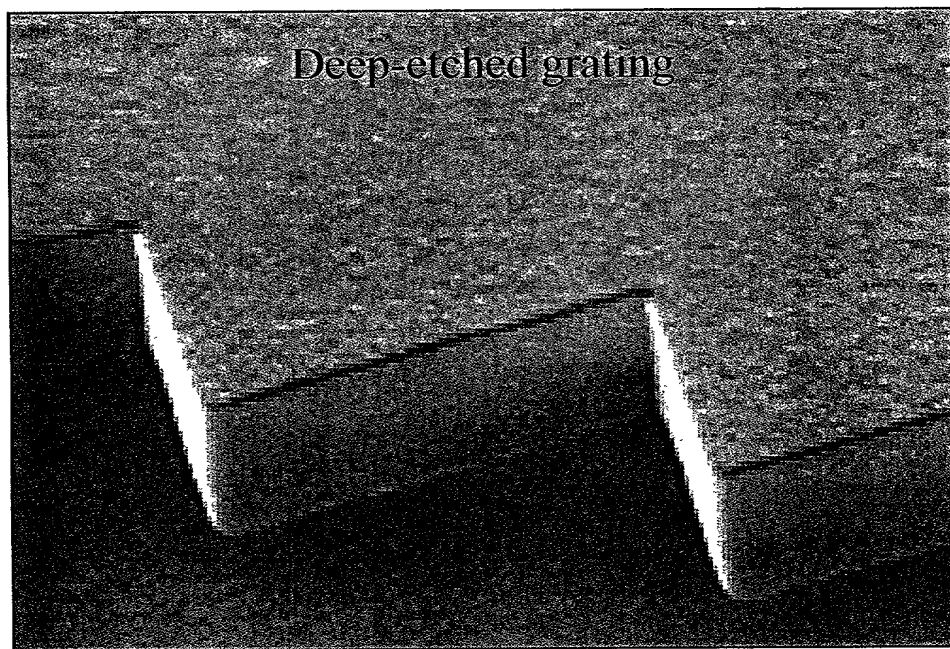


Figure 12

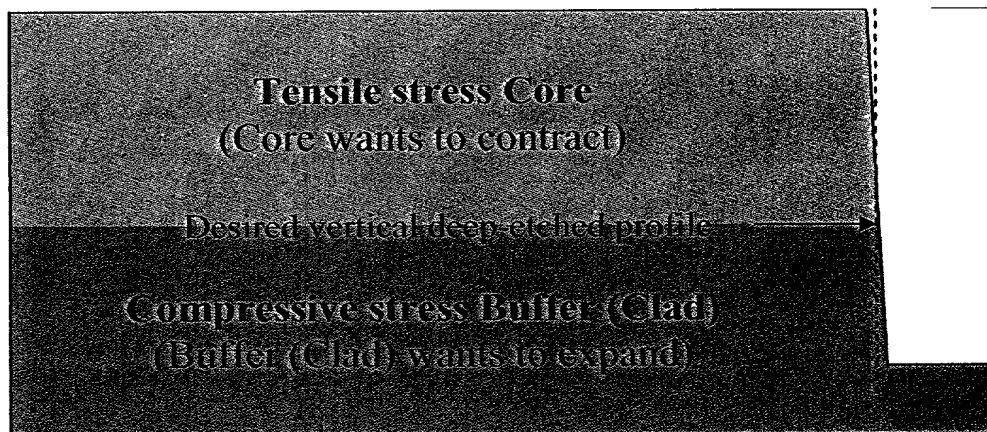
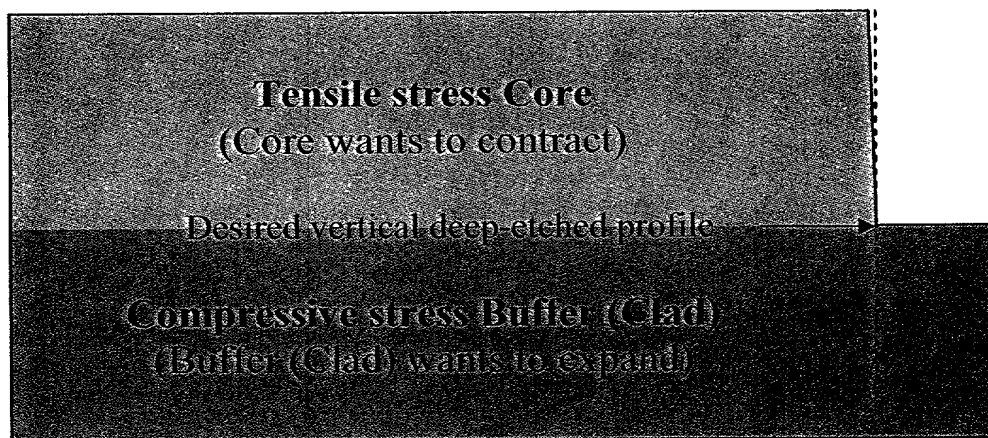
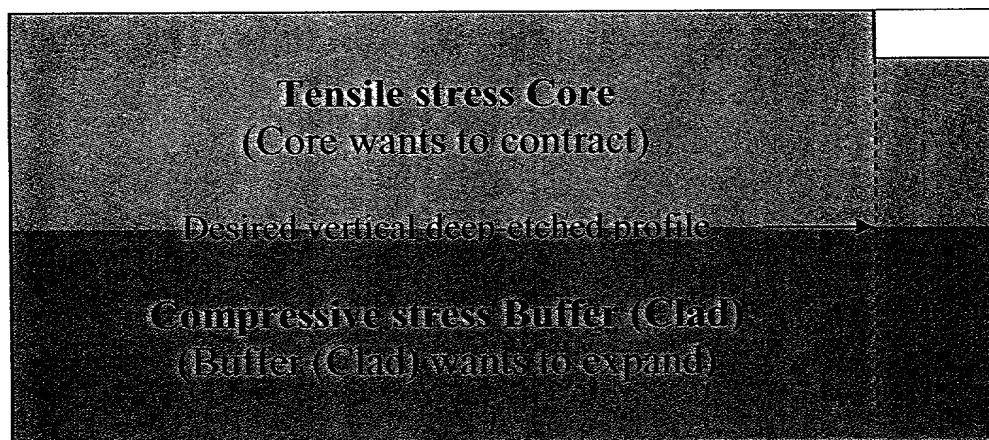
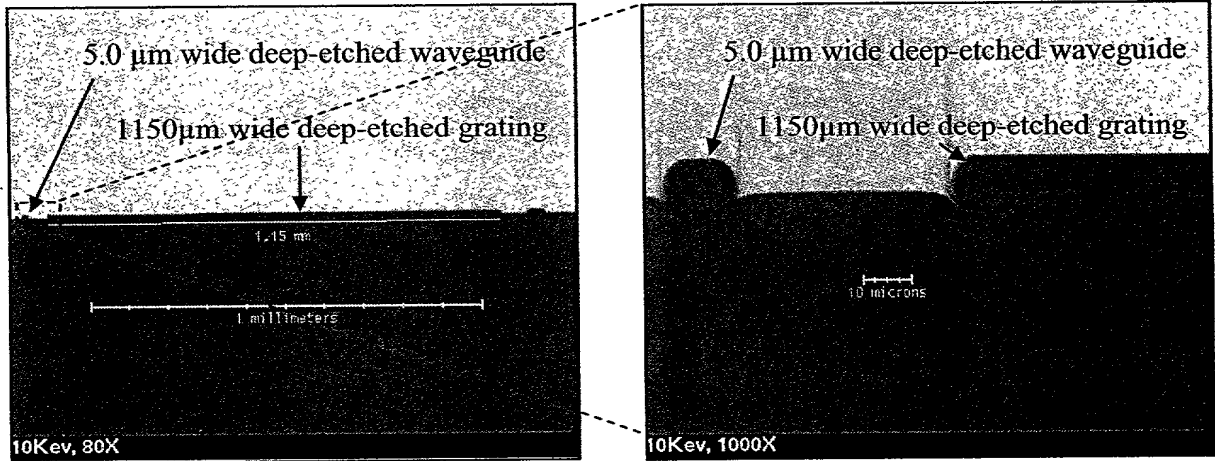
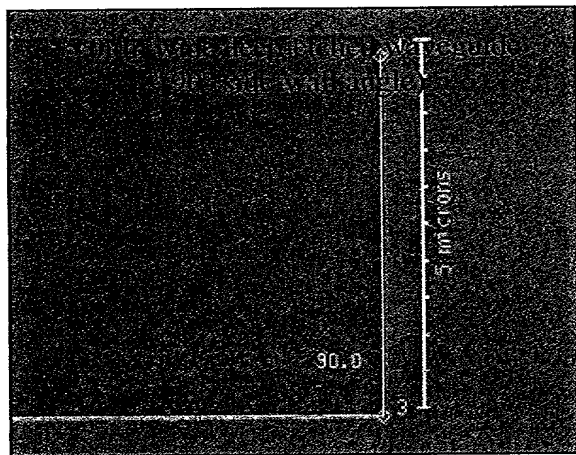


Figure 13

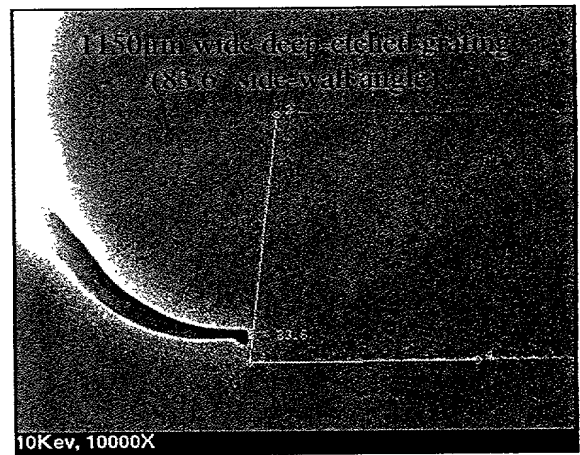


(a)

(b)

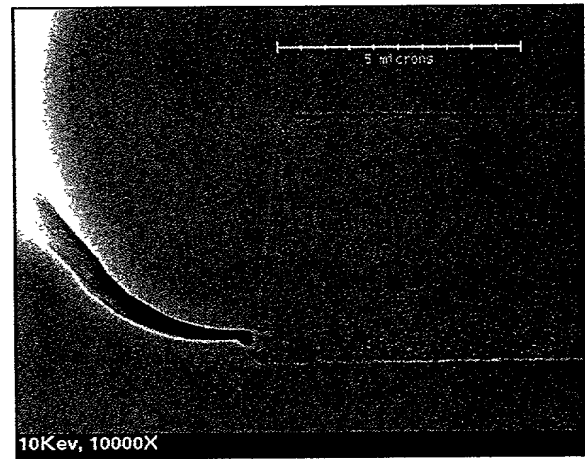
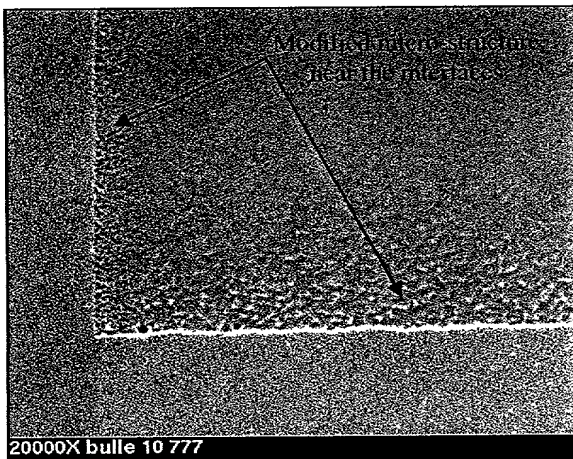
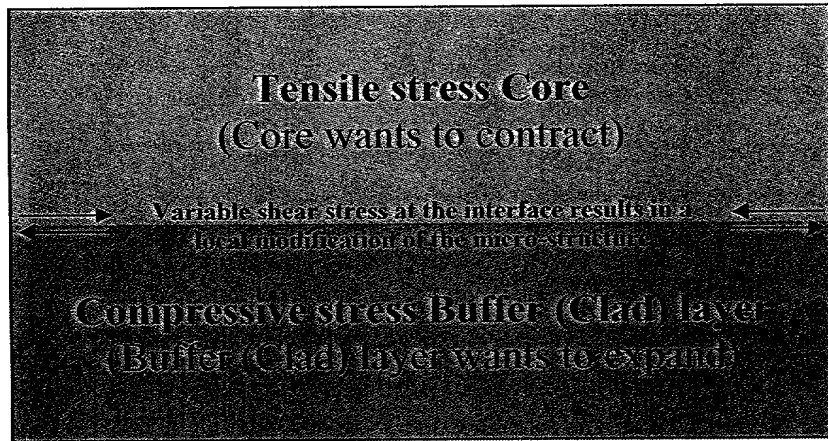


(c)



(d)

Figure 14



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Figure 15

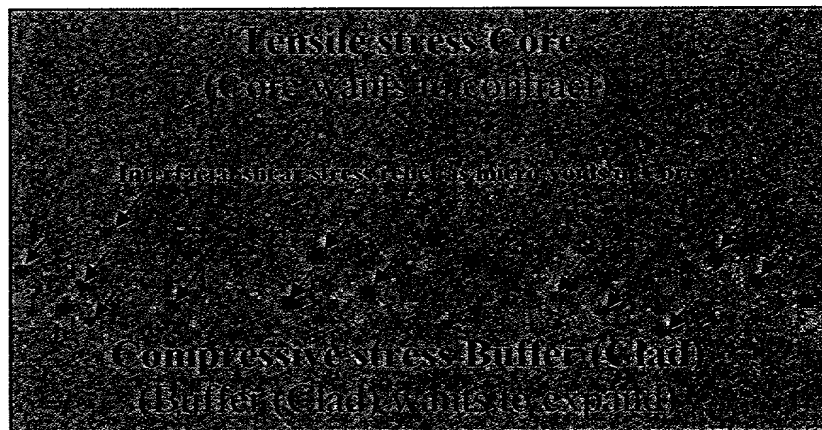
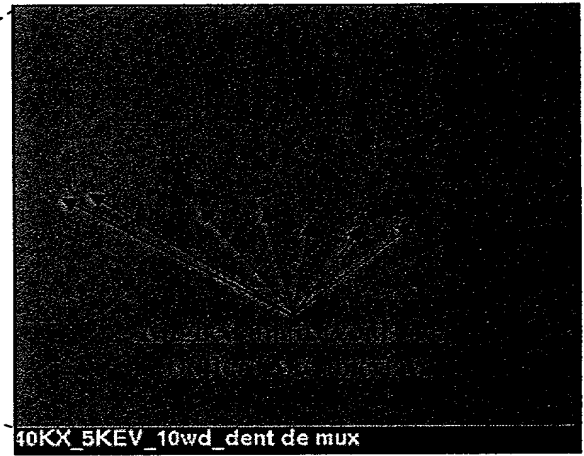
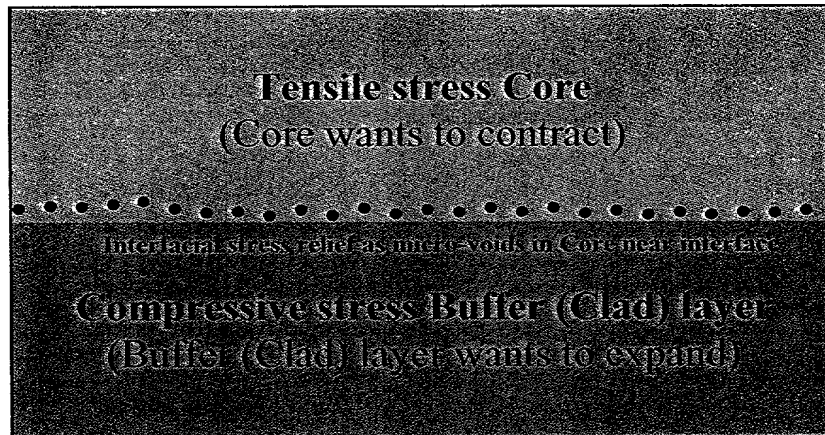


Figure 16

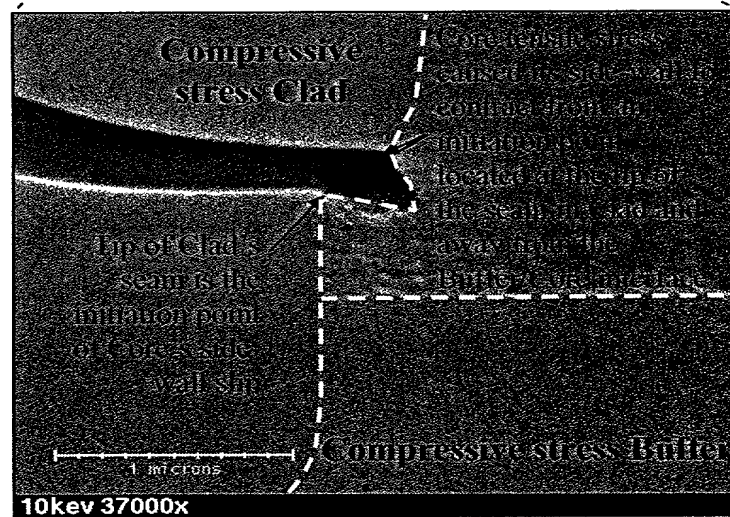
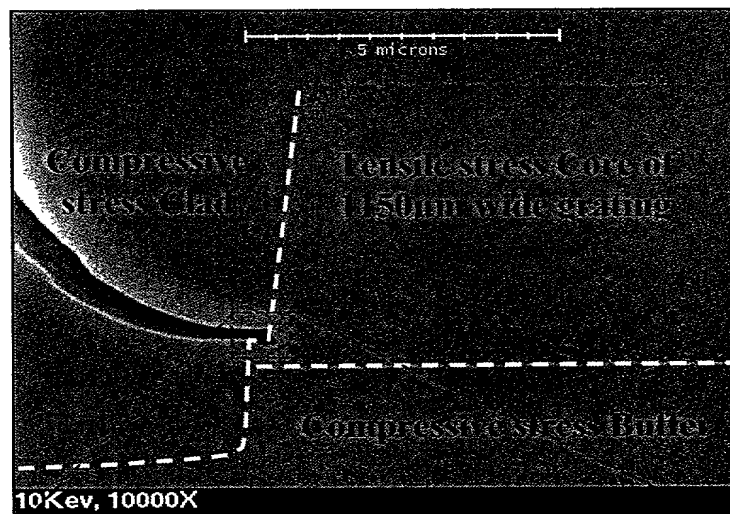
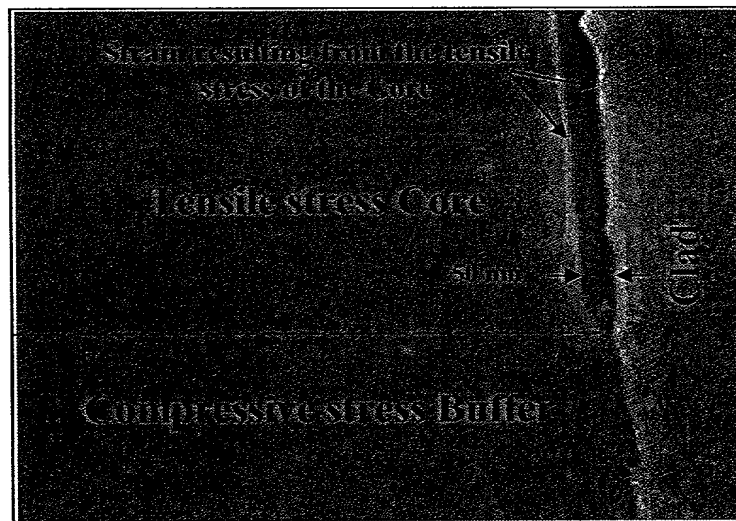
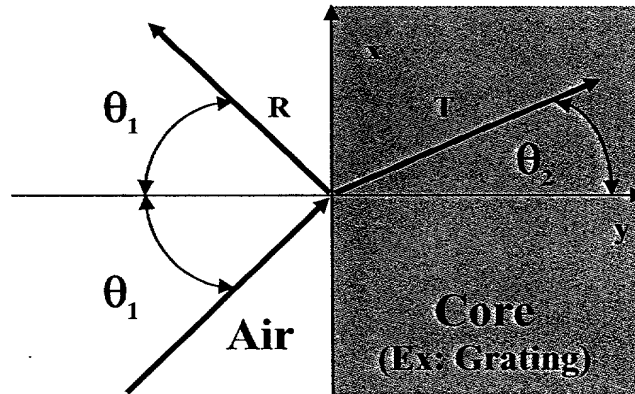
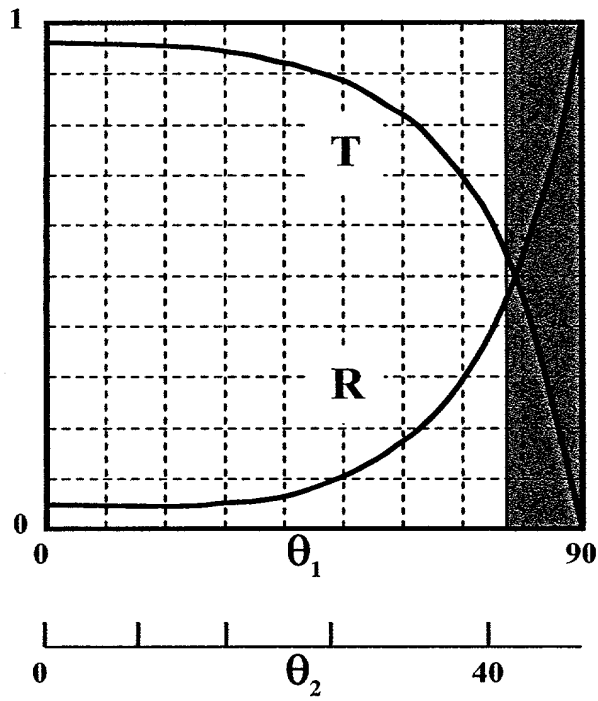


Figure 17



Electric Field \perp Plane of Incidence



Electric Field \parallel Plane of Incidence

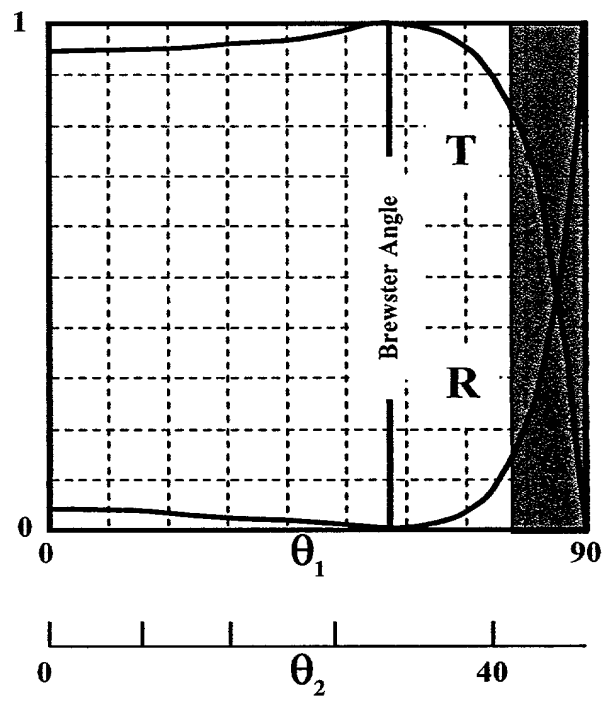
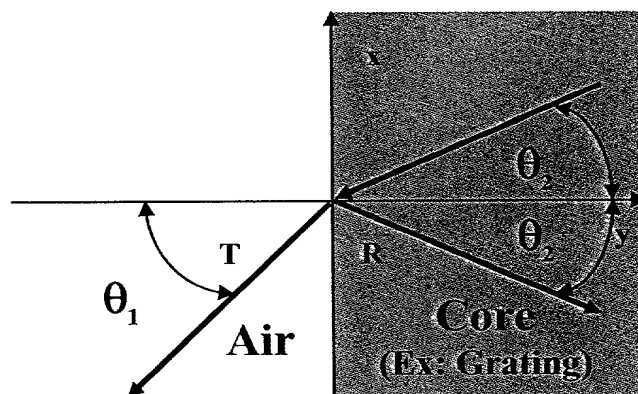
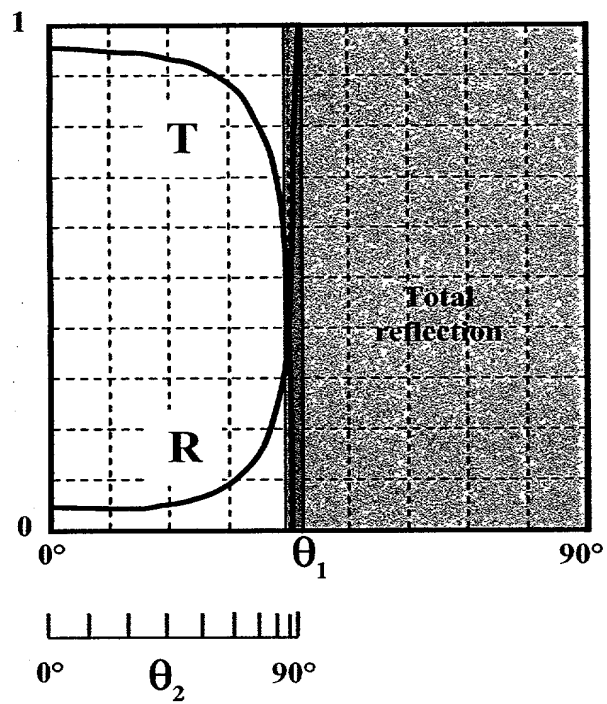


Figure 18



Electric Field \perp Plane of Incidence



Electric Field \parallel Plane of Incidence

